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The Foundry Trades' Equipment and Supplies Association

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Nebulosities

A number of definitions of terms relating to cast iron have been proposed by Committee A-3 of the American Society for Testing Materials. Cast iron itself is defined as an "Iron containing so much carbon that as-cast it is not usefully malleable at any temperature. Usually from 1.7 to 4.5 per cent. carbon is present, and in most cases an important percentage of silicon." We think that this might equally well read "A range of high-carbon-iron alloys admitting of a number of subdivisions each capable of reasonably distinct and separate definition." We admit that it postpones the issue, but it does draw attention to the fact that cast iron is a range of alloys rather than one entity.

Pig-iron is defined as "Cast iron usually produced by smelting iron ores in the blast furnace. It may have been cast into pigs or held in the molten condition for charging into a steel-melting furnace." This seems a very reasonable definition, but we are not too pleased with the next one—grey iron. This is defined as "Cast iron having a grey fracture. It is readily machinable with ordinary tools. The combined carbon usually does not exceed 0.8 per cent." The fault with this definition is that it does not differentiate sufficiently grey iron from malleable cast iron. An improvement could be effected by inserting the words "as cast" after "grey fracture." The actual definition of malleable cast iron is "Iron, white as cast, which has been made malleable by annealing," and this is adequate. There are two other definitions which call for comment. One is semi-steel—"A vague trade name for various cast-iron products made by adding steel to the melting charge." It carries a significant footnote which reads "The term never had a real meaning and should be considered obsolete." The second reads: "High-Test Cast Iron—A term formerly used to designate grey cast iron having a minimum tensile strength of 28,000 lbs. (12.5 tons) per sq. in." A footnote calls attention to the obsolescence of this term as it has been standardised under A.S.T.M. designation A.48.

So far as the former—semi-steel—is concerned, we are sure that the A.S.T.M. epitaph will have the endorsement of the whole of considered British opinion, but for high-test or high-duty cast an interim definition may be desirable from the British angle, as engineers are asking just what is covered by this term. Actually it is a range of recently-developed alloys, based on cast-iron foundry practice, which exhibit improved properties designed to withstand abrasion, acid and alkali attack, high temperatures and severe mechanical stresses of various types. In fairness to the A.S.T.M. we should emphasise that these proposed definitions are published as information only and that suggestions for revision are solicited. We congratulate the committee on the clarity of its expressions, which should go far to remove from technical nomenclature the nebulosities generally associated with semi-steel and high-test cast iron.

Iron Roads

A distinguished engineering contemporary has recently given some attention to the question of roads and highways, and offers praise to the cast-iron road, which deserves the careful attention of all founders and road users. Pointing out that the maintenance and repair of public highways in Great Britain costs the community some thirty millions sterling per annum, it criticises the frequency with which they have to be pulled up, and says that, in the light of modern knowledge, road foundations should be permanent. Until a few years ago only one type of road satisfied all the requirements of strength under load, durability, weatherproof qualities, silence, absence of skidding, and ease of replacement, that is granite setts dressed to a smooth surface. This, however, is very costly, and a competitor has appeared, far cheaper to install, with equally attractive qualities, the road paved with cast-iron blocks.

Inquiries have been made among highway engineers and road users, and all lead to the same conclusion, the excellence of the cast-iron blocks. Although adverse criticism was particularly sought, not one of a serious character was found. The most important was a certain tendency to skid, but not greater on the iron setts than on other surfaces, and the complaint arose principally among cyclists. It is said that the contention of the makers that iron setts are absolutely non-skid requires further investigation, which it is thought would lead to satisfactory results. The only other complaint has been that in some cases the setts have worked loose. This occurs rarely, and is attributed to bad laying. The bitumen used should be spread on thoroughly-dried and matured concrete, to a minimum depth of half an inch. It is stated that, while a few problems remain to be settled, the iron road is so good that a considerable length of important highway should be laid with it. The cost works out dearer than concrete or asphalt, but cheaper than granite, and the life is probably comparable with the latter, and extensive use in a few years time is predicted. We have not hesitated to quote the opinions expressed, because they are given with complete impartiality after a careful examination of the facts, and constitute a striking recommendation for this type of road surface. Its possibilities in foundry tonnage will be patent to all.

Telescope Castings

The second largest telescope in the world is to have important parts of nickel cast iron. The telescope is being erected on Mount Locke in South-Western Texas, and will be housed under a rotating dome weighing 125 tons. The wheels which are to carry this weight are cast from special high-test nickel alloy iron to ensure maximum toughness, strength and machinability.

The declination circle of the telescope presented a problem which led to the specifying

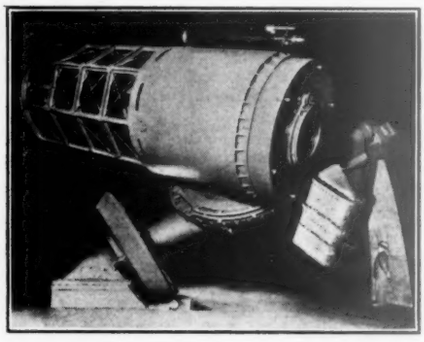


Fig. 1.—The New Telescope for the University of Texas.

of nickel cast iron for this part of the telescope's equipment. As this casting consists of a variety of sections, warping or cracking may well have occurred at the junction of heavy and light sections if ordinary cast iron has been employed. Because of its greater uniformity of

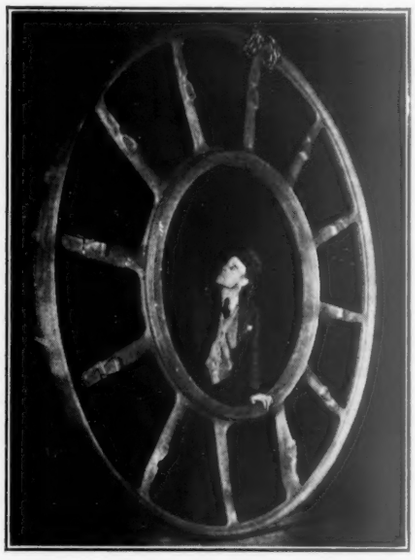


Fig. 2.—A Large Nickel Alloy Iron Casting Incorporated in the Telescope.

structure nickel cast iron lessens the possibility of cracking and provides a casting having fewer internal stresses and therefore less susceptibility to distortion.

U.S. Production of Malleable Castings

The production of malleable steel castings in the United States in 1935 was 466,395 tons, compared with 369,458 tons in 1934, an increase of nearly 20 per cent., according to statistics compiled from reports of 112 manufacturers with 21 plants, producing 88 per cent. of the total value of the output in the industry reported in the census for 1933.

Book Review

La Fonte Malleable (Malleable Cast Iron), by E. Schuz and R. Stotz, Docteurs-Ingénieurs. Translated from the German by René Castor, Ingénieur des Arts et Manufactures. Published by Dunod—92, rue Bonaparte, Paris (6°). Price 164.80 fcs., bound, registered post, net; 154.80 fcs., paper covers, registered post, net.

This volume is worthy of the careful consideration of all malleable founders. It begins with a rather lengthy historical survey, in which the work of Réaumur naturally figures prominently. But it also mentions the interesting fact that Prince Rupert, nephew of King Charles I and the leader of the Royalist Cavalry in the Civil War, was granted patents in 1670 and 1671 for "A new invention or art of prepareing and softening all cast or melted Iron so that it may be fyled and forged as wrought iron is." It also notes that about a dozen years later this process was in operation in England and that Continental manufacturers were coming to this country to acquaint themselves with its practical details. Apparently this is the first recorded instance of the manufacture of malleable iron.

The authors are to be congratulated on the thoroughness with which they have dealt with the various methods of melting the metal and with the annealing of the castings. Their thoroughness makes one wish they had devoted more space to moulding and coreshop practice. One would gladly have spared the whole of the historical section for a fuller description of sand preparation, coremaking and the special moulding technique necessary to produce solidity and freedom from cracks in the hard castings. This section of the book is too sketchy to give complete satisfaction.

The various furnaces used for melting the metal are discussed in an excellent manner. The influence of different alloying elements on the results obtainable is set forth with considerable clarity, and the opinions advanced are backed up with definite facts and figures.

Even more satisfactory is the description of the many types of annealing furnaces. The practice of annealing, with its many pitfalls, is very well stated. The theory of annealing is one of the most complete it has been our pleasure to read. While one cannot entirely agree with all their findings, the points of difference, when compared with the points of agreement, are so small that it seems invidious to mention them.

The work contains a very good selection of micrographs illustrating every phase of production, although some of them appear to have suffered a little in reproduction.

It is a book to be recommended to all interested in the manufacture of malleable castings. It is considered that a translation into English of the sections commended would have a ready sale.

D. W.

Purity of Carbonyl Iron

Iron of a very high degree of purity, made by a process in which iron carbonyl is decomposed to give metallic iron and a gaseous constituent, has been regarded as a material on which the fundamental characteristics of the element can be determined. However, spectroscopic and analytical evidence obtained by the National Bureau of Standards have indicated that carbonyl iron is not always so free from impurities as it has been claimed to be, and recently, determinations of the temperature coefficient of resistivity of carbonyl iron wire have given results which are not so reproducible as similar determinations on some other types of high-purity iron. These results, it is believed, can be interpreted to mean that the structure is not always uniform, and that the impurities in carbonyl iron, minute in amount as they may be, are inclined to be segregated.

Speculation in Metals

By "Onlooker."

The non-ferrous metal markets in Whittington Avenue with the facilities which they offer for dealing in futures have always had an attraction for the speculator, and if many retire from the fray after burning their fingers there are always others to come along and fill the gaps, for the desire to "get rich quick" is just as strong as it ever was, and we are most of us gamblers at heart! Your true speculator is, of course, a born optimist, but there is a subdivision into blind optimists, and those who exercise a certain amount of caution and discretion in the view which they take of the future. Had not humanity hung on to hope as a kind of primitive instinct the race would have suffered extinction long since, for goodness knows there have been disappointments on a never-ending scale since the dawn of life on this planet! However, hope lives on in spite of it all, and just because of that we have formed the habit of believing that somehow or other there must come a change for the better in the not far distant future. Hence the magical significance to the speculator of buying the three months position "for surely in three months something *must* happen." It usually does, but the price trend is not always what the operator expects!

The very fact that the London Metal Exchange is a free and open market available for the speculator makes it dangerous for him, since it means that other interests all over the world are at liberty also to send their buying and selling orders to Whittington Avenue. However favourable the outlook for any particular metal may appear to be, it is obviously impossible to say to what extent extraneous factors may operate to upset the prospects. That is what happens only too often on the metal markets, and the effect on a big bull account of some item of adverse news is usually to send the speculators scurrying for cover. The net result of this is a wave of selling which brings values down with a run, and upsets confidence all the way round. On occasions of this kind it is not unusual to find that there are stop-loss selling orders on the market, and even though the tonnage to be disposed of without a limit may not be very large, buyers sit back and the over-anxious speculator usually disposes of his holding at well below a reasonable figure. The "mass movement" by speculators is no uncommon phenomenon for they buy together and sell together, very much like a lot of sheep whose individual reaction is negligible. The wiseacres—in a minority unfortunately—are satisfied with a small profit, and get out while the going is good, their motto of "small gains and quick returns" being a golden rule for speculation.

Generally speaking, the speculator in metals elects to go on the bull tack and buy futures for the rise, in spite of the fact that the contango is against him. The really experienced market operator, however, takes the opposite view, and by selling the three months position after a sharp upturn, in the expectation that the rise has been overdone, awaits a reaction with confidence. He at any rate has the satisfaction of knowing that time works in his favour for week by week the contango is running off and making a profit more likely. Thus the speculator swings the market up and down while the ordinary trader looks on wondering whether the movement is genuine or not. Is it any wonder, therefore, that manufacturers seem to be rather slow in getting off the mark when prices improve with a sudden rush? Sometimes the speculator starts a genuine rise and on the lowest computation he livens matters up considerably in Whittington Avenue.

Modern Coreshop Production*

By W. H. SMITH (Director, Foundry & Engineering Co. (West Bromwich), Ltd.)

The subject of "Modern Coreshop Production" covers a very wide field, and within the limits of a technical Paper can only be reviewed in a general way. After making brief reference to the principal elements in coreshop production, it is proposed to describe the methods adopted by a few of the more progressive foundries to bring their coremaking into line with present day demands, and reduce their production costs. Taking the industry as a whole, the coreshop has not so far received the consideration its importance in modern foundry production calls for.

Continuous casting has made great strides during the last three or four years, so much so that the general lay-out is to a great extent standardised, varying only in size and capacity, or in constructional details. The same cannot be said of the modern coreshop. Whilst available space, or existing buildings, have some influence on lay-out, the varying requirements, and special methods of production adopted in the different foundries, have given us an equally wide range of lay-out, as will be seen later in the shops to be described.

Before considering any particular modernised coreshop it may be as well to run through the main essentials in core production. Starting with sand preparation, this generally involves passing the sand through a dryer either of the rotary type, or if requirements do not amount to more than 2 or 3 tons per day a small stationary dryer answers the purpose.

It is not proposed to enter into details of sands or binders, as core production on modern lines allows almost unlimited variation in this respect. There are many good mixing machines available, in types to suit all purposes. The industry is also well catered for in the matter of core binders. Most shops standardise their own core-sand mixtures to suit various classes of cores; usually not less than two, or more than five, different blends are used.

Sand Distribution to Coremakers

Whilst some modern foundries have adopted mechanical methods of distributing the mixed sand to coremakers, others have not found the cost of conveyor distribution justified. This is due in part to the complication of varying sand mixtures, and to the relatively small tonnage to be man-handled. The labour distributing core sand supplies is generally worked in conjunction with the mixing. Further reference will be made to both manual and mechanical sand distribution later.

Arrangement of Core Benches, Machines, etc.

The first considerations are the supply of adequate sand supplies to the operator, and the finished cores away to the stoves with minimum effort and expense. In arranging lay-out everything depends on the type of work to be produced, shop space available, and its relation to other foundry buildings and plant.

Coreboxes

Generally speaking, the type of corebox is controlled by the means adopted for making the cores, the quantity of cores required, degree of accuracy necessary in the finished core, and type of labour available for the coremaking. All modern coreshops are not given over to mass production, or even to "repetition," and for many purposes the ordinary pine box, or even the open frame and strickle, suffice for the job. Many straight cores are, of course, extruded by means of multiple or single die machines, which require no corebox. Machines of this type are producing cores up to 4¼ in. dia. with about ¾ in. hole and 20 in. long at the rate of one every 40 sec.

For modern quantity production, and where dimensions have to be maintained to close limits, all-metal coreboxes are almost essential, and these require constant checking to ensure that neither the box itself nor loose pieces become distorted or out of position due to wear and tear. Anyone familiar with modern engineering repetition work realises how quickly a distorted corebox or pattern will produce a formidable heap of scrap castings, which more frequently checking in the pattern shop would have obviated.

Where wood coreboxes are employed all loose pieces should be of hardwood, or metal for preference, and too much stress cannot be laid on the importance of a strong outer frame built up to resist the rapping in every direction. Coreboxes worked on machines stand much longer than those worked loose on the bench. Small vibrators for attachment to machines can now be obtained which save the necessity for hand rapping and increase the effective life of coreboxes. Another accessory which is useful for certain types of small core work, such as valve cores, is the pneumatic corebox clamping device. This secures the two halves of the box together whilst it is rotated in the horizontal plane for finishing the print ends, and during the vibrating before taking out the core.

In the lay-out for automobile cylinder and similar types of work there is ample scope for the skill and ingenuity of foundry and coreshop managers deciding on the best method for making—or splitting up—the coremaking for a particular job, but obviously quantities, and the resources of the shop, have always to be taken into account. Take, for example, the comparatively simple automobile gearbox core, wherein several production methods immediately suggest themselves. These suggestions are:—

(1) *Corebox in halves.*—In this case each half is turned out and dried on separate plates. It involves a minimum cost for the corebox, whilst the coremaking is simplified. There is a quicker drying, but special jointing operation is necessary afterwards.

(2) *Corebox in halves, with dowel pegs and clamps.*—Here the core is made on the bench and dried whole. It requires rather more skill for producing the core and longer drying. There is the joint line only to dress off, but it ensures a more accurate job.

(3) *All-metal box (whole) with all bosses dovetailed inside.*—In this case a girl rams it up as a single core and draws it on a turn-over machine; she then removes the drawbacks which form the bosses, leaving a complete core without any joint line. It involves a more expensive corebox, but yields about three times the output.

(4) *Corebox in halves mounted on machine.*—May be turned over and drawn sideways.

(5) *Duplicate metal coreboxes in halves with taper clamps.*—Here the cores are made on a coreblower. It necessitates an expensive lay-out, but gives much faster production, and is only possible on a quantity of, say, 5,000 upwards.

In the more intricate work connected with engine monoblocks and heads, and similar work, additional output is often obtained by dividing what could be a single core into two or three comparatively simple cores to be made by as many operators. This has the advantage of utilising less skilled labour than is necessary for intricate cores; also, what is generally of greater importance, doubling production of the particular part. Against this, however, has to be set the extra subsequent labour gauging the separate parts, assembling after drying and re-checking. In some cases it is possible to assemble such cores with the sectional boxes and dry them as a single core—which, of course, is more economical.

Whilst this dividing-up method does, in many cases, assist production, and overcome the difficulty of obtaining skilled coremakers, it raises the cost after the drying process, and there is undoubtedly more risk of faulty castings where cores have to be jointed than where a single core without joints is put into the mould.

Fig. 1.—The Coreshop of Morris Motors, Limited.

* Paper read before the Birmingham Branch of the Institute of British Foundrymen.

Many intricately-shaped cores are produced in a single box made up entirely of loose segments bolted or clamped together in an outside frame, which has to be taken apart to release each finished core.

Even to-day 60 to 70 per cent. of the lighter cores used in this country are made by girls or youths, either on the bench or on simple turn-over machines; there is, however, still a demand for the skilled male coremaker, quite apart from that of loam coremaking which it is not proposed to discuss. Coreblowing machines have made some headway during the last two or three years, although in common with many other mechanical contrivances they have definite limitations. These are not, perhaps, as narrow as some have assumed, and in many cases failure on certain jobs has been due to improper venting of the corebox, or unsuitable core sand rather than to the machine. The first machine of this type seen by the author was the Demmler, which was followed by the Borrmann and the Osborne—two others of the vertical type available, also the "Rocket," a somewhat simplified type of vertical machine, and the Coleman or "Albertus," which is a horizontal pattern, of unique design. Any rate of output mentioned in connection with a particular machine should not be regarded as its maximum by comparison with another make. The main factor regulating output from a coreblowing machine, assuming the blowing operation has been properly adjusted, is not the actual blowing of the core, but the time occupied removing cores, getting boxes changed, and ready for resetting. To obtain maximum output from some coreboxes three operators are required, whilst with others two are enough.

Cores which are not self-supporting as they leave the corebox have of necessity to be supported, either on a bed of backing sand, or in "dryers" or "shells." Much time is lost if blown cores have to be put on backing sand—metal dryers are essential for getting full output of cores which are not self-supporting. Patterns for these and the finished metal dryers are sometimes regarded as too great an expense on a job, and a substitute in the form of an oil-sand shell is sometimes used. This is made with a strong oil-sand mixture, containing about double the normal proportion of core oil, actually moulded on a dried core placed in the half corebox, in the same manner as when using backing sand, except that it is rammed hard, and afterwards dried separately on a core plate. These last quite a long time, and can easily be replaced. It is not suggested that they are equal to a properly finished metal dryer, but cores are more effectively dried in them than on loose sand, and there is less risk of sagging cores.

Handling Green Sand Cores

Large and heavy cores must of necessity be transported either by overhead crane or bogie truck of some description to the stoves, and of these crane handling is preferable, as there is less risk of damage from shock or vibration than with floor transport. Cores which can be dried by the continuous process should either be placed on the stove trays direct or on a suitable conveyor, which will take the cores away immediately they are made straight to the stove for drying. Here the continuous system eliminates losses from breakage of green cores. It is very important that the conveyor used for green cores should be entirely free from vibration or shock.

The type of continuous stoves illustrated in this Paper are fairly well known. They dry both large and small cores, within their size limits, uniformly at a fuel cost varying from about 10d. to 1s. 6d. per ton of cores. They also extract all fumes from the shop, and deliver the cores cooled off so that all the smaller sizes can be easily handled.

A modified type of this continuous stove is now available, known as the Acme Junior. It has the same characteristics as the original three-stage type; first, preheating and preliminary drying; second, finish drying and oxidising by fresh air injection, and final cooling off before delivery. Cores larger than about 6 ft. long by 2 ft. wide or 2 ft. high are more economically dealt with in stationary stoves on transport racks or bogie trucks.

Cores which have been dried by the continuous system are dealt with by various methods, and can best be described in connection with some of the shops it is proposed to consider. The following indicates the variables:—All cores are taken off the coreplates or dryers, and are inspected and dressed off. Some are blacked, whilst others do not need it. Some are jointed, and gauged, or assembled in jigs. The blacked cores are either returned to continuous stoves or put through an auxiliary blacking dryer. The cores are then passed into storage, or directly into the foundry. The coreplates and drying shells are either returned by conveyor, or, as is more often the case, redistributed by hand truck. Specially heated storage chambers are often provided for cores made with binders susceptible to take up moisture from the atmosphere.

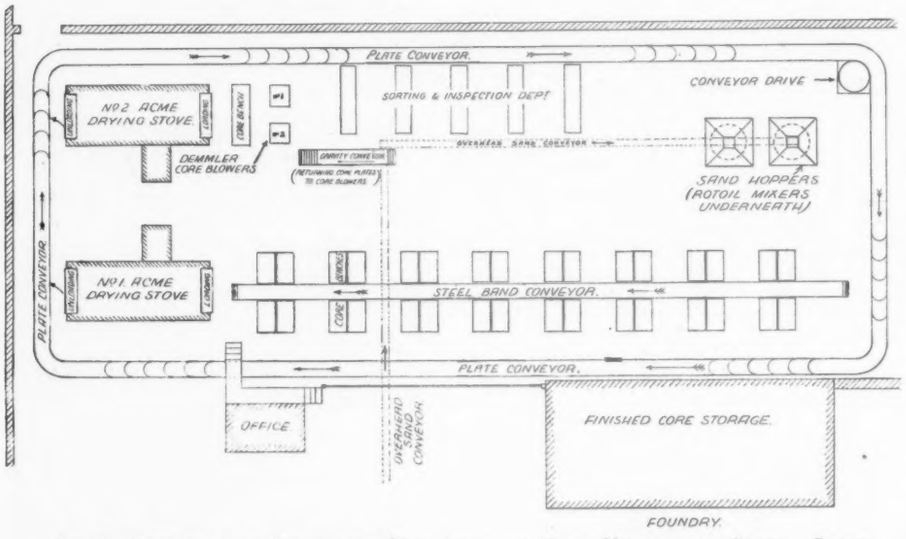


Fig. 2.—Coreshop Laid Out for the Production of Motor-Vehicle and General Light Castings.

Shop No. I—The Morris Coreshop

In reviewing the development of foundry or coreshop mechanisation, we in this country owe something to Morris Motors for the lead they gave in this direction. When the Coventry foundry was built there were very few firms with either the necessary capital or sufficient courage to make so radical a departure from existing British practice in the interests of progress. As frequently happens with genuine pioneer work, many alterations to the original lay-out were found advisable for getting the best results, and to the credit of the firm, be it said, that they have not hesitated to scrap and replace plant where necessary for improved production.

Morris Motors reclaim a large proportion of their core sand, which is passed through a rotary dryer with a special arrangement of blades inside, to assist disintegrating of small lumps of cores, the larger core pieces being first put through a crusher; the sand for re-use passes through a screen, and the fine silt is drawn off by an induction fan. This sand and the new sand (after drying) is stored in separate bunkers, from which supplies are fed in vary-

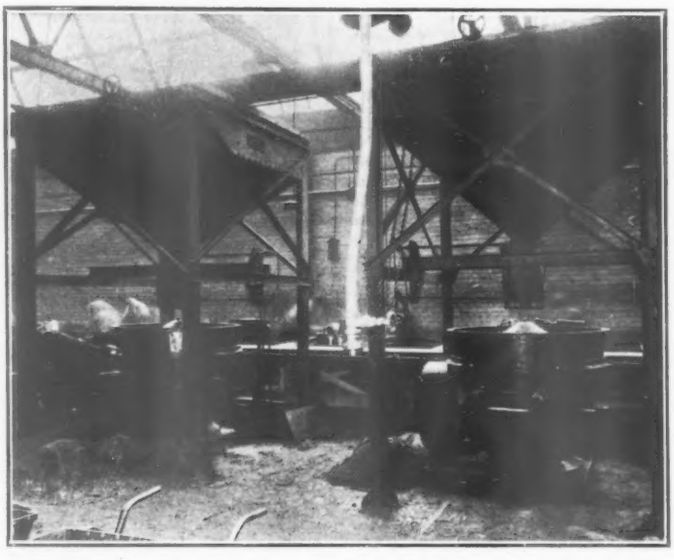


Fig. 3.—The Coresand-Preparing Department for the Shop shown in Fig. 2.

ing proportions on to a travelling band for delivery to the mixers.

The mixed core sand is discharged from the machines into the boot of an elevator, which delivers it into a series of hoppers terminating a few inches above benches. The coremaker scoops the sand into his corebox from this supply, and places his finished cores on the conveyor for conveying to the stoves for drying.

Fig. 4.—The Continuous Core-Drying Stoves Erected in the Coreshop shown in Fig. 2.

Fig. 1 shows another group of coremakers' benches for lighter cores, which are supplied with sand by hand truck, and the finished cores carried by steel band direct to the drying stoves, each of which on full production handles 8 to 9 tons of cores per day. After stoving, the cores are checked over for essential dimensions, some being automatically ground to exact size on a revolving table-type grinder. They are then blacked either by dipping or spraying, passed through a further short period stoving, and then into temporary storage or direct by pendulum conveyor to mould assembly.

Shop No. 2

This is next in order of date among the shops under review and although laid out over four years ago it is one of the best of its kind even to-day. There have been detail alterations and additions made recently, but the rough plan, Fig. 2, gives a general idea of the original lay-out.

Silica sand is unloaded from trucks at the side of the foundry where it is put through a rotary dryer, and afterwards automatically conveyed by a Redler overhead conveyor across the foundry—cooling to some extent in the process—and delivered into storage hoppers immediately above the Rotoil mixers at the lower end of the coreshop (Fig. 3). The sand hoppers are fitted with an adjustable sand-measuring device for supplying the mixers.

Fig. 4 shows the two continuous stoves at the top end of the shop. One is fed from a steel-band conveyor, which collects cores from 40 corebenches ranged on either side of it. A number of fairly large cores will be seen on the stove, and smaller ones on the nearest corebench—all these go through together and are uniformly dried. In front of the stove on the right will be seen a table; this is for receiving and unloading cores from two "Demmler" core-blowing machines to which two others of different make have since been added. The author has seen manifold pipe cores produced on these machines over four years ago at the rate of two per minute.

The stoves shown in Fig. 4 not only dry, but cool the cores, and were actually the first three-stage stoves to be built, the two earlier ones having no cooling chamber. The dried cores are unloaded on to a plate conveyor which passes right round the shop, and serves several purposes. First the cores are carried round, with any dryers or shells to the gauging and inspection station, where they are taken off, and dryers and plates placed in boxes for return by the plate conveyor and steel band or auxiliary roller conveyor back to the coremakers. Cores are passed into boxes and also carried on plate conveyor to core stores, which are arranged at the point nearest to the foundry to which they are issued and booked out as required.

Shop No. 3—Ley's of Derby

The next shop to be dealt with is the main coreshop of the largest malleable foundry in Europe, that of Ley's, of Derby (Fig. 5). The unique feature of this plant is that its mechanical transport for cores consists of a single steel-band conveyor, 200 ft. long, which performs several operations. Obviously, this lay-out is only suitable for a long shop. Sand preparation is carried out in the top corner of the shop, and distributed to corebenches by truck. The girls' section accommodates about 130 operatives, and this 200-ft. steel-band conveyor takes their cores into an adjoining section, where they are taken off on to a pair of Acme vertical continuous drying and cooling-off stoves. In addition, these stoves take cores from a pair of duplex pneumatic machines specially adapted for making strainer bush cores, and from Borrmann core blowers.

After drying and cooling, the cores are unloaded back on to the steel band, where they pass on to inspection and gauging benches and any blacking and jointing required, which in this particular shop is a very small matter. Finally, they arrive at the storage section, from where they are eventually distributed to the foundry. This coreshop provides for the requirements of the main foundry, which is producing about 300 tons of malleable castings every week.

There is a duplicate of this shop for men and boys in the new section, which is another complete unit, with moulding and dressing shops, annealing ovens, pulverised fuel and generating plant, capable of a further 300 tons per week, but this department has, so far, only reached about half-capacity. A pair of small stationary-type drying stoves is used for any blacking or jointing drying-off required in connection with each continuous dryer, or for outsizes in cores which cannot be passed through the continuous stoves, the limits of which are 5 ft. 6 in. by 16 in. by 16 in.

(To be continued.)

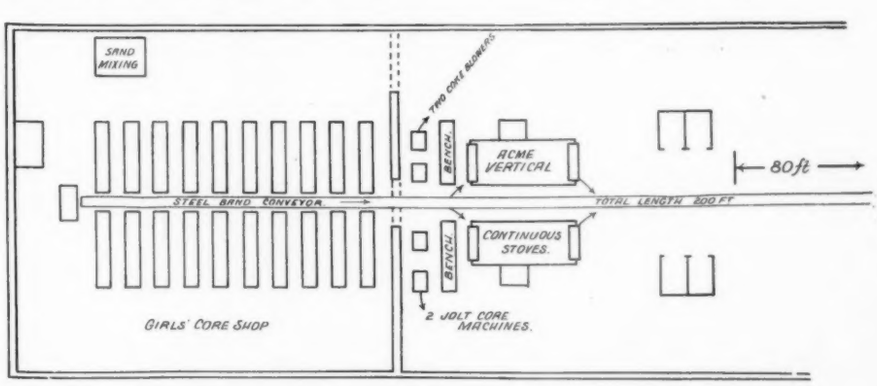


Fig. 5.—The Lay-out of the Coreshop of Ley's Malleable Castings Company, of Derby.

Andrew Carnegie Gold Medal

At their meeting held on March 26, 1936, the Council of the Iron and Steel Institute decided to award the Andrew Carnegie Gold Medal for 1935 to Dr. D. F. Marshall, of Sheffield, for his Paper on "Further Determinations of the External Heat Loss of Blast Furnaces," which was published in the "Journal of the Institute for 1935," Vol. No. 1.

D

Motor Vehicle Cylinder Bore Wear

By A. SMITH (Late Foundry Manager, Morris Motors, Limited)

These notes are based on many years of practical experience in the manufacture of cylinder block castings of practically all types and many variations in analysis, together with observation of the results in service. An excellent opportunity of studying the performance and results of running with varying analyses of metal has been afforded, both with and without some of the more expensive elements included in the mixtures. As a consequence a rather definite opinion as to what is the most suitable analysis and material for the particular service to which these cylinder blocks are subjected has been formed.

Causes of Wear

There are four main reasons which are very closely associated with each other:—(1) A rather slack specification; (2) unwise buying of castings; (3) the use of unsatisfactory material in their production, and (4) poor foundry methods.

No mention has been made of faulty machining; poor assembly, or corrosion and erosion. The very high state of efficiency attained in the machine and assembling shops eliminates the first two from any calculation, and if the casting is what the writer would consider satisfactory for its purpose, the two last might be ignored as of negligible quantities.

Specifications

The specification is so slack that any foundry can keep within its limits and produce castings which are unsatisfactory by reason of obtaining an analysis in which, though it conforms to the specification, no effort has been made to hold a proper balance of the elements. The wise and conscientious foundry manager will always do his best to maintain a satisfactory balance of the elements, but there are others who do not exercise such care.

Buying

During the past few years buyers have been living in a paradise, and have placed orders with second-grade foundries. This has not been to the general good, as the life of the castings has been sacrificed in the effort to get the very cheapest that can be produced. These castings really prove very expensive, as the customer, who is the final arbiter as to the success of any concern, is not satisfied with the life of his engine before it requires reboring.

Poor Material

The use of unsatisfactory material in the production of these castings is largely caused by the factors given above, and the buyer would profit substantially by discussing more fully with the manager of the foundry from which he obtains his supplies, not only the question of analysis, but the materials used to obtain the result which he desires. It is well known that two irons of different makes may have exactly the same analysis, and also that that analysis will be the only thing they have in common. The tests, the structure and the price will be totally different, and so the one must be ruled out entirely when it is a question of producing cylinder castings for engine building. Obviously, the buyers cannot know all about the complexities of cast iron, especially when it is realised that foundrymen themselves do not yet know half enough. That is why it is suggested that the buyers should discuss the matter more fully with their foundry managers, which would be to their mutual benefit and to the ultimate benefit of their companies, because, after all, the real value of a casting of this type can only be expressed as a percentage of cost on road miles covered, so that if one casting which costs, say, 15 or even 20 per cent. more than another, actually does 50 or 75 per cent. more miles on the road before reboring is necessary, then the more expensive casting in first cost is infinitely the cheaper in the end. The 15 or 20 per cent. may be expressed as the difference in cost of good or bad foundry practice, plus satisfactory material. The 50 or 75 per cent. is best expressed as customer's satisfaction.

Poor Foundry Methods

By poor foundry methods is meant that some of the methods used are unsatisfactory for the production of castings of this type, though the methods are quite up to date in many respects. They are not always calculated to give the best results in the vital parts of the casting, and so for this reason one is bound to consider them as inferior methods. This is largely brought about by having to reduce prices to just below the rock bottom which would have given satisfaction. Consequently the cheapest practice that could be evolved in conjunction with the best material that could be afforded at the price has been introduced. This is not satisfactory. Industry should aim at getting the best material and the best practice to give the maximum life at the lowest possible cost to the customer.

A Suggested Research

There has been a fair amount of price-cutting in recent years; now it should be replaced by some real competition on the question of quality, and to ensure this it is suggested to the car manufacturers that they carry out tests with different makes of castings over 15,000 or 20,000 miles on the road and then have the cylinder blocks carefully checked over. They will be amply repaid for this by being able to give their buyer the best possible information as to what is, and what is not, satisfactory for their particular job.

Phosphorus in Cylinder Castings

The author has from time to time had the pleasure of reading in The Foundry Trade Journal of the ill-effects of phosphorus in castings, with numerous illustrations to seal the argument of the research worker. As a result one is almost driven to the conclusion that it is impossible to produce a sound casting if the phosphorus content exceeds 0.2 per cent. This to the writer is proof of poor foundry practice. He acknowledges that it is much easier to produce a sound casting with a phosphorus content of this order than when it reaches 0.6 per cent., and so the foundries have taken the short cut, without considering the life of the casting sufficiently. Phosphorus has supplied quite a large amount of entertainment in various foundries, and so seems to have been almost universally condemned on that account. It is significant that no data (seen by the author) deals with the ill-effects of a very low phosphorus on the life of the resultant casting, and yet many are aware of the fact, but persist in evading the true issue. Whilst trying to replace the virtues of phosphorus with other elements, in the author's opinion it will be a very difficult matter to obtain the same life in the casting at the same cost, because in all the tests personally carried out, nothing has equalled the castings carrying a generous phosphorus content, in fact, after trying out castings with small percentages of such elements as vanadium, titanium, nickel and molybdenum, nothing has given the same satisfaction on the road as a medium-phosphorus content.

Phosphorus is the life and soul of elements contained in cast iron and will reinstate or install life in that alloy when metallurgists have learned to handle it intelligently. It must not, however, be allowed to exceed normal limits. Keep it balanced and a good reputation for cylinder production will be enhanced. It will be gathered from the above that the author is an advocate of a medium-phosphorus content in cylinder practice, and if he were buying cylinder castings he would not consider purchasing any with a content of less than 0.4 per cent. But analysis is only one thing in a casting. Like pig-iron, two castings may be produced by different methods, having the same analysis but an entirely different structure, so that in order to produce the best many factors must be taken into consideration.

Foundry practice must be such as to give the best results in service. That is, care must be taken to get the parts of the casting that are subject to wear as hard as possible. Reputable irons must be used and the furnace practice must be satisfactory. The following analysis which should please customers is:—T.C., 3.35; C.C., 0.8; Si, 1.7; Mn, 1.0; S, 0.1; P, 0.6 and Cr, 0.2 per cent.

It must be clearly understood that the above is essentially a cylinder analysis, and though it will give excellent results in many castings of other types, it is much better to consider the job and the service for which it is to be used before fixing analyses of other types of castings.

French Foundry Technical Association

ELECTION OF NEW OFFICERS

The French Foundry Technical Association held its annual general meeting on March 18 in Paris. After the Committee's report on the general and financial position, the meeting confirmed the admission of new members. Afterwards 13 members of the Committee were elected for three years, in place of those retiring this year. Immediately after this meeting the Committee met and elected its officers for 1936. They were:—

President.—Mr. Maurice Werts, of Les Fils de A. Werts foundry at Pantin, Seine, who was previously Senior Vice-President, was elected President in place of the Honorary President, Mr. E. Ramas, whose term of office has expired.

Senior Vice-President.—Mr. A. Brizon, Engineer E.C.P., managing director of the Foundry A. Brizon, at Courbevoie, Seine.

French Vice-Presidents.—Mr. A. Dady, President of the Foundry Friendly and Mutual Aid Society; Mr. J. Derdinger, brassfounder, Honorary President of the French Non-ferrous Employers' Federation; Mr. Ch. Koehler, general secretary to the French Foundry Employers' Federation, and Vice-President of the Arts and Crafts Old Students' Association; Mr. J. Lobstein, President of the Paris Ironfounders' Employers' Federation; Mr. L. Montupet, managing director of the Montupet Foundries in Paris; Mr. H. Strube, President of the French Non-ferrous Employers' Federation, Engineer and Founder, Montrouge, Seine; and Mr. H. Sandre, Director of the Perigord Metallurgical Company, Paris.

Foreign Vice-Presidents.—Belgium: Mr. J. Léonard, President of the Belgian Foundry Technical Association, Liège.

Spain: Mr. J. M. Espana, honorary Spanish commercial attaché, Paris.

Italy: Mr. F. Jarach, Vice-President of the Italian Federation of Mechanical and Metallurgical Industries, Milan.

Grand-Duchy of Luxemburg: Mr. L. Brasseur, Engineer, A. and M., Luxemburg.

General Secretary.—Mr. Roger R. Meyer, manufacturer, Paris.

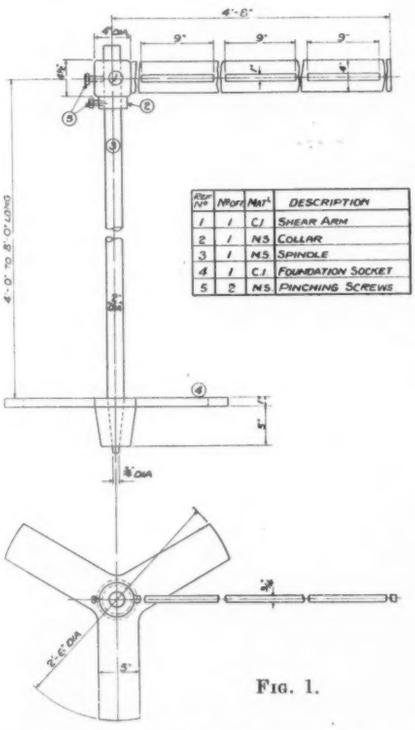
Treasurer.—Mr. D. Waeles, Vice-President of the French Non-ferrous Employers' Federation, brassfounder, Montreuil-Sous-Bois, Seine.

A Plea for Loam Moulding*

By ROBERT LIDDLE

In preparing this Paper, the author has endeavoured to keep before him the very varied views that exist in foundry practice, but he does not offer an apology for the method adopted in treating this thesis. It is the belief of a great many men, who are closely related to the foundry industry, that so much has been said, and the changes have been so rapid within the past few years, that the problem of loam moulding has apparently disappeared. This results because of the scarcity of this particular type of craftsman in the foundries of to-day.

In the writer's opinion it is to be deeply regretted that this view should be held, apparently for very varied reasons, by so many distinguished founders. It would appear, however, that the main reason given is that in loam moulding the cost is considered high. At the same time it is generally agreed that this type of moulding is very safe, and the castings produced equally good, when compared with those moulded by other methods.



Ref. No.	No. off	Mat'l.	DESCRIPTION
1	1	C.I.	SHEAR ARM
2	1	M.S.	COLLAR
3	1	M.S.	SPINDLE
4	1	C.I.	FOUNDATION SOCKET
5	2	M.S.	PINCHING SCREWS

Fig. 1.

For the benefit of those who are not altogether familiar with this subject, the writer has had some sketches prepared in an endeavour to illustrate more clearly the plant required for casting simple jobs, having cylindrical or spherical contours.

In Fig. 1 is shown a group of components including crosses or footstep socket, spindle, and spindle arms which will at once be recognised by all who have even the slightest knowledge of foundry work.

It is desirable to stress how essential it is that the parts illustrated in Fig. 1 must be made from good quality steel. If they are not to be machined all over, bright bar steel must be chosen. Now in the manufacture of these component parts great care should be taken to ensure that all sizes are to gauge, so that, when assembled each part will fit properly to place and have only the predetermined clearances, otherwise, one could not rely on their being perfectly true. The producing of such parts as described is not costly, and provided reasonable care is taken, either, while in use or while lying in store, they will give many years useful service.

Standardised Components

To eliminate the carrying of large stocks of this kind, sockets and spindles are made to standard sizes. A master spindle should be kept as a gauge for sizes, so that in the event of replacements being required, the correct dimensions can be readily obtained.

The short spindles can be used as mandrels with which to cast sockets or crosses and makes the operation very simple: an open sand mould is made to the dimensions desired for the cross, then the mandrel cleaned, heated, coated with plumbago water, and dried and inserted into the boss of the cross. Care must be taken to have the mandrel plumb and passing through the bottom of the mould face at least 1 in. This, then, leaves a fine hole, hard wearing and definitely true. The boss should be purposely kept short, so that any spindle will fit, as when these parts are standardised, many hours are saved. Personal experience has shown that the lack of standardisation in some foundries is appalling, and much time is unnecessarily lost looking for the particular size or type of apparatus required. It will not be necessary to press any further the benefits derived from standardisation, as from the foregoing remarks in conjunction with Fig. 1, one can readily appreciate the time and labour saved.

In addition to the foregoing, and as shown in Fig. 2, an equipment is detailed which can be used for any kind of loam job where an ordinary spindle can operate, as well as strickle half-circles apart, extended sections of circles, and eccentrics. Detail of an eccentric block is shown in Fig. 2A.

As can be seen from Fig. 3, there is an added advantage in using the spindle, in so far that a number of parts can at the same time be assembled, such as a right-arm pole, or eccentric arm bearing, for the purpose of stricklingout branches or large facings on the core or mould as required. It is interesting to note that the right-arm pole can be set to any desired degree, and with the addition of a second pole, set from the first, any branch can be strickled, in almost any position, as is shown in Fig. 3.

Fig. 4 illustrates similar component parts which have greater utility. The arm faces and the other movable parts must be accurately machined to make a sliding fit. These parts are especially designed to sweep any shape or contour desired. The board being hung and balanced, can travel out or in along the line contour at bottom flange, or template, as required.

Cylinder Moulding

Fig. 5 shows a cylindrical vessel, 12 ft. dia. by 10 ft. deep, and this, to some, would appear a big proposition, but to moulders accustomed to this class of work it is a simple job, but expensive to cast, as the formation gives large dimensions for little weight, and to the founder this means maximum area to find, and weight to handle to produce such a vessel having a thickness of $\frac{3}{4}$ in. or $\frac{7}{8}$ in., with flanges $1\frac{1}{4}$ in. or $1\frac{3}{8}$ in. thick.

In Scotland, the method favoured is to build with the usual spindle and boards, but with a building ring inserted every fourth or fifth course, this being done to help resistance. It is imperative that the job is rammed up in a pit, or in cribplates. On the other hand, the practice adopted in England is to have rings with prods 10 or 12 in. long cast on, to hold the brickwork against casting pressure, which, of course, eliminates the need for ramming. However, it must be remembered that these rings are costly, and, if stored, take up a considerable amount of space. On a straightforward one-off job, no great saving can be accomplished; the only comparison to be made, as to these alternative methods, is that, by the English practice, ramming is eliminated, whereas in the Scottish method the rings can be produced at a lesser cost. In addition to the methods generally adopted in Scotland and England, another procedure is to set up the cope board in the usual way, and build, with a building ring on the line of the bottom flange, this being repeated after each layer of bricks. By this method 20 rings would be used in building a vessel 10 ft. deep, and this, it will be noted, is twice the amount required by the Scottish practice, and 12 more than required in the prodded or English procedure.

In the order stated the weight of metal would be 100 per cent. more and 20 per cent. less; the difference in time of manufacture would be 50 per cent. less and 100 per cent. more. The time required to build these three different types of mould would be approximately the same. The Scottish method requires ten rings, has a total weight of 48 cwts. and takes 17 hrs. The English system with eight rings (having prods) has a

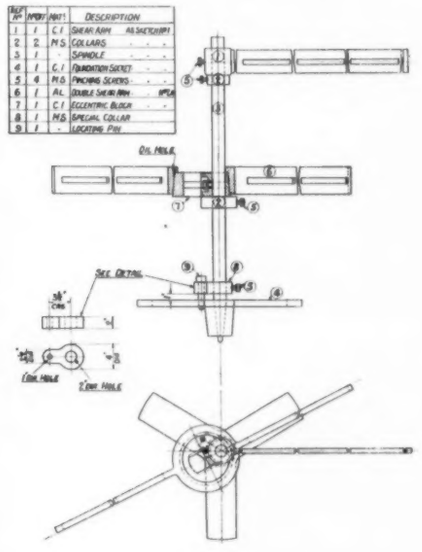


Fig. 2.

total weight of 105 cwts., whilst the time taken is 64 hrs. The third method, with 20 rings, has a total weight of 96 cwts., a time of 34 hrs., and to this, if one adds ramming and time required for digging out after casting, would involve 140 hrs., that is, about £7 extra on the Scottish method. This money cannot be recovered on the saving from the cost of a smaller number of rings used on the Scottish method. In the foregoing it is assumed that these rings are in the stock yard where the various methods mentioned are wrought.

So far there would appear little saving on production costs, but then one must not forget to consider the time saved during ramming and digging, and also yard accommodation saved through reduced amount of tackle. In the event, however, of this being a job where two or more are required, the procedure would be slightly altered, in so far that it would only be necessary to build the core and cope once, it being salved after the first cast. It will be readily appreciated that time and money are saved by this method which can be easily accomplished if three joints are made on each section of the mould as is shown in Fig. 6.

* A Paper read before the Scottish Branch of the Institute of British Foundrymen, Mr. D. Sharpe presiding.

It will be noticed that the cope ring is brought into line with the bottom flange, and the dual reason for this is, that it carries the completed cope to the stove, and keeps it intact until the casting is stripped from the mould. By taking the full depth of the flange, it is a check on the pressure at the greatest point. This is done by sweeping a joint at the level of the flange and having the lifting plates cast to the desired shape, so as to fit around a third of the

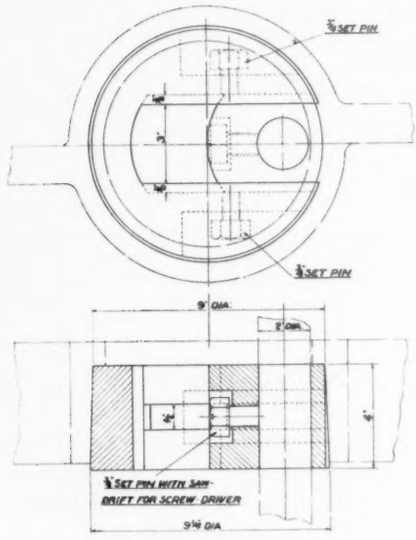
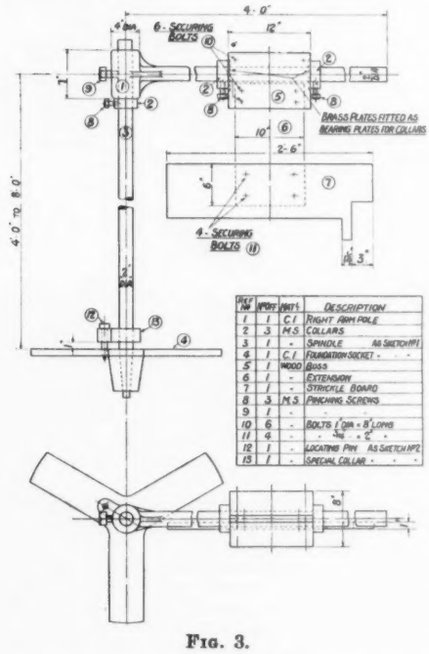


Fig. 2A.

circle, less 2 in. It must be done, however, so that it will clear any projections which may come in line, and each section should have four 1-in. lifters cast on them, and so arranged that the load will be evenly distributed when lifting. A lug should be cast on, 2 in. from each end, and at least 6 in. by 4½ in., as it has to be utilised for tying the job firmly together.



PART No.	NUMBER	MATERIAL	DESCRIPTION
1	1	C.I.	RIGHT ARM POLE
2	3	M.S.	COLLARS
3	1	-	SPINDLE AS SKETCH NO 1
4	1	C.I.	FOUNDATION SOCKET - -
5	1	WOOD	BOSS
6	1	-	EXTENSION
7	1	-	STRICKLE BOARD
8	3	M.S.	PINCHING SCREWS
9	1	-	-
10	6	-	BOLTS ⅝" DIA × 8" LONG
11	4	-	- ⅝" × 2" -
12	1	-	LOCATING PIN AS SKETCH NO 2
13	1	-	SPECIAL COLLAR - -

Fig. 3.

The building rings should be made to fit exactly the shape of the lifting plates, and have holes cored in them sufficiently large to allow an easy passage during placing. Care must be taken that all rings are made up from the side of the hole to the lifters, as this helps to bind the complete building.

Coremaking

The core is jointed in much the same way, a lighter plate or a heavy type of grid may be used, each section having four lifters cast on, the plates should be somewhat shorter so as to allow for three triangular easing bars about 2 in. less than the length of the core to be built. Then to complete the gear required for the core, three further stiffening rings with dimensions as that of lifting sections and with cored holes to clear the lifters.

Patternmaking

To build this job it would only be necessary for the pattern shop to supply the boards shown in Fig. 7. The plain bearing board is used for first casting only: the flange board is cut to sweep the flange giving the desired thickness for all castings required, and as no bearing-board sweeps the edge of the bottom flange, the flange board is set to size for doing this, and is cut to allow the stripping piece to be withdrawn as shown. A cope board has the top flange-piece formed on it, its length being equal to the depth of the casting minus the thickness of the bottom flange.

A core board should be the whole length of the casting, with a straight board forming the top, and this with cope and core gauge sticks, completes the necessary plant so far as the pattern work is concerned.

Assembling the Mould

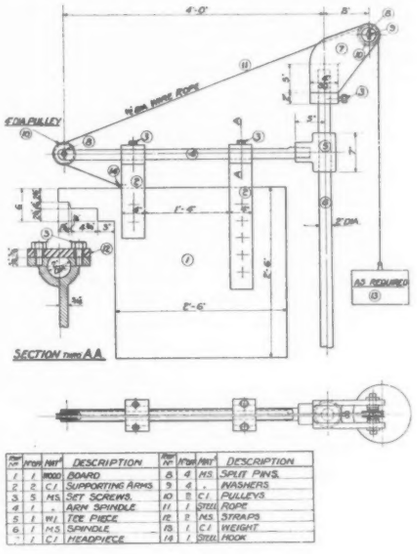
To assemble this job, proceed along usual lines, which are as follow:—A bottom plate is laid down with the cross and spindle fixed in the centre on a good level foundation, so that the spindle will be vertical. This plate must have four lifting lugs, and be at least 6 in. to 8 in. broad, but the shorter lugs should have a 2-in. square slotted hole cored on the edge of the plate at centre of the lugs. The object of these holes is to receive the bolts for binding before casting. In general these plates should be designed approximately 1 ft. 4 in. larger than the flange of the casting, and should be of robust design, as a considerable load may have to be carried on it, to and from the stove for drying purposes.

The bearing board marked No. 1 in Fig. 7 may be set and the section for cope ring finished. The cope ring is then set in place and bearing board marked No. 2, used to sweep the joint on the cope ring, which should clear the flange of the casting when completed. When it is sufficiently set, it can be swept to the desired thickness with either sand or soft brick, and then both the cope board and the first lifting plate set and the latter built up in the usual manner. Care must be taken, however, that all plant used is made strictly to given dimensions, so that the other sections will have sufficient space to accomplish easy fitting.

The first section now being completed, it is obvious that all other sections required, will be built in exactly the same manner, finished and strickled up. These sections have now to be bolted together, and in a job such as this, the proper size and number of bolts required should be in the store, ready for use, thereby saving time and trouble at a busy moment. This brings one to the point of how many bolts should be used in such a case as this, and to this the writer speaks from his personal experience. He has found it advisable to have quite a number of bolts and washers strong but light, so that one man can bind a section without assistance. When the bolts are effectively tightened the cope should then be skinned and parted, care being taken to mark the cope ring and the bottom section of the mould for assembly.

Core Assembly

Work is now commenced on the core. The board is set, the lifting plates laid in position and kept sufficiently apart to allow the required space for the easing bars to be inserted, and it is advantageous to have these covered with brown paper, which should receive a coat of blackwash, as by this means an ideal joint is made, and the bars can be easily withdrawn from the core after casting. To complete the building is a comparatively easy job, and if the grids have been stayed at the lifters, these sections will be fit for use for quite a long time with very little repairs. Having now been strickled and allowed to set, it can be put into the stove to dry.



PART No.	NUMBER	MATERIAL	DESCRIPTION	PART No.	NUMBER	MATERIAL	DESCRIPTION
1	1	WOOD	BOARD	8	4	M.S.	SPLIT PINS
2	2	C.I.	SUPPORTING ARMS	9	4	-	WASHERS
3	5	M.S.	SET SCREWS	10	2	C.I.	PULLEYS
4	1	-	ARM SPINDLE	11	1	STEEL	ROPE
5	1	W.I.	TOE PIECE	12	2	M.S.	STRAPS
6	1	M.S.	SPINDLE	13	1	C.I.	WEIGHT
7	1	C.I.	HEADPIECE	14	1	STEEL	HOOK

Fig. 4.

The top portion can now be considered, as it still has to be built. The plate for this section should have 2½-in. prods and be of the same size and shape as the bottom one. It should be covered with stiff loam, ½ in. in excess of length of prods. This is now ready for the stove, and when dried is placed on a socket or jig to strickle up a level face. Circles of the core and cope diameter can be drawn on the face

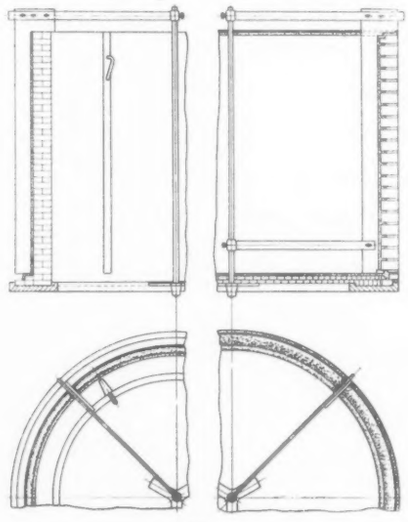


Fig. 5.

and the gates marked off and passed through the top to complete the building.

Finishing Operations

When drying is completed the bottom plate with core may be bedded in a pit for assembly, and if set level there should be no cause whereby trouble can arise. It is necessary that the cope should hang definitely vertical, so that it can be lowered gently to the marks already referred to. The thicknesses should be examined and, if

correct, the cope can be lifted to ascertain that no crushing has taken place, and when correct relaid in place.

The top is now turned over and the inlets on the top side of the plate made up to suit the gate pins to be used in forming the head. If the gates are checked and found correct, the top can be put in place, the joints sealed up,

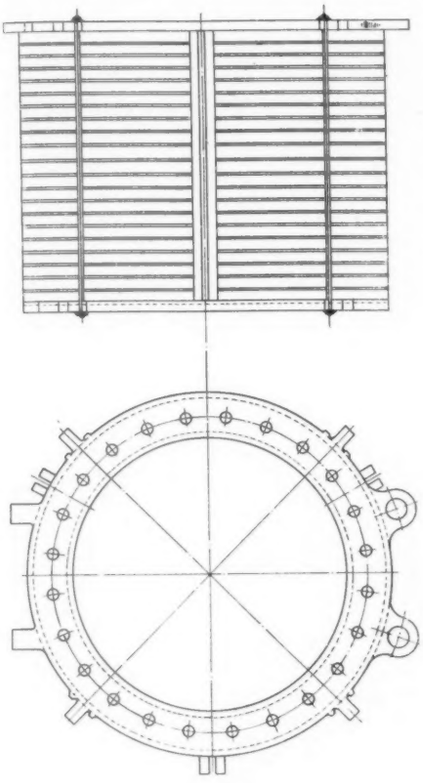


Fig. 6.

and finally the top plate bolted tightly to the bottom with six $1\frac{3}{4}$-in. dia. bolts, fitting into the slots already described. To complete the head, it is necessary to use crib plates on the outside, and two rows of bricks built on end, in the inside, and when this is completed the job can be cast.

Stripping

The easing of the casting can be carried out in approximately 30 to 45 minutes later, and, with the aid of the crane, the bars can be withdrawn from the core. The cope section may then be eased under the top flange by removing the top layer of bricks from the cope.

The following morning all binding material can be removed to allow the sections to be taken apart. The core sections can be lifted out and laid on the floor, and the cope parts can also be set, either on the top part or on a suitable temporary site, then the casting sent to the dressing shop. This leaves the bottom bearing with the cope ring in position, which has not been disturbed. The loam face, if taken away leaves the brickwork in perfect condition to strickle up, this can be done with the aid of No. 2 bearing board, as shown in Fig. 7. The stripping piece removed allows the flange to be strickled to the desired thickness. The cope board is now checked for size, and the sections forming the cope are placed and examined for positions by trying the board round each section as laid down before the crane is taken away. If the operation is done with the aid of marks on the cope ring, it becomes a comparatively simple job. The difference in time on, say, a three-off job, as against three castings made under usual foundry practice is very considerable and really worth while.

It is to be understood, that many other types of castings other than those produced by the equipment already described, are made by other methods, and still retain the advantage of not requiring a complete pattern, such as is required, when being cast by a sand medium.

High-Pressure Cylinders in Loam

The writer also wishes to deal with the class of work which is really intricate, and has a great labour value, because of the time spent on producing such castings no matter what type of moulding is adopted. The present custom followed by most executives in large engineering firms to-day, is to endeavour to determine whether it is cheaper to make a pattern or cast in loam, but their lack of knowledge and experience in loam practice, generally weighs the balance in favour of a sand casting.

From Fig. 8, *et seq.*, the writer is desirous of showing how that the saving from loam moulding should be greater than from jobs where patterns have to be made and cast in sand. Fig. 8 shows a sectional arrangement of a high-pressure cylinder when cast, and this in conjunction with the following sketches will help to show the method of producing such a casting. Fig. 9 shows a group of templates required for making a high-pressure cylinder, and it is to be noted that the more intricate it may be the cheaper will become its final cost, as in ordinary circumstances, longer time would be allowed to produce a more difficult casting, than a straightforward one.

The method adopted in moulding such an article as this, would be to use a spindle to sweep the bearing or print, and bottom mouldface. Care must be taken that the spindle is truly vertical and the foundation or bottom moulding plate, perfectly level. This plate must be at least 12 in. greater, each side, than the size of the job to be cast. Fig. 10 shows the bottom of the mould mounted on the bottom plate. The larger lugs on the sides are required in order to lift the load built thereon, including the casting contained in the mould, and it is obvious therefore, that in determining the thickness of these lugs, a fairly high safety factor should be employed throughout all calculations. The smaller lugs shown are for binding purposes. The face is strickled to correspond with the face of the board, which has been shaped to suit the particular job in hand.

core built up and strickled complete. The practical moulder may consider the method wherein the main core remains stationary to be unorthodox, but nevertheless it has a dual advantage in that (1) if, when the plate is being designed, a sufficiently large hole is allowed for the gas to have free escape then there is no need to fill the cavity of the core which is usually done in standard practice, and (2) it ensures a much truer centre on which to assemble the cores and other parts of the mould. The wood flange being withdrawn this section can be stiffened or dried in the stove, it may then be finished and finally dried. The centre lines can now be drawn lightly over the full length of

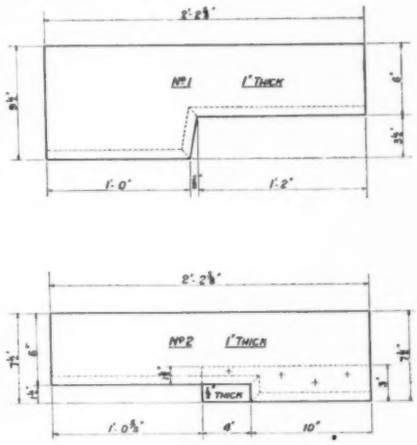


Fig. 7.

the core, and if proved correct, it could be left until required.

Before dealing with the building of the core and cope for the other sections the author would like to mention that it is beneficial to have work on all sections proceeding at the same time, and this is especially true when the job on hand is required for urgent delivery.

Fig. 11 shows the side plate in position to commence building, the dimensions of the plate should be 2 ft. longer than the cylinder, and approximately 2 in. less than the distance between the inside top and bottom flanges, so as

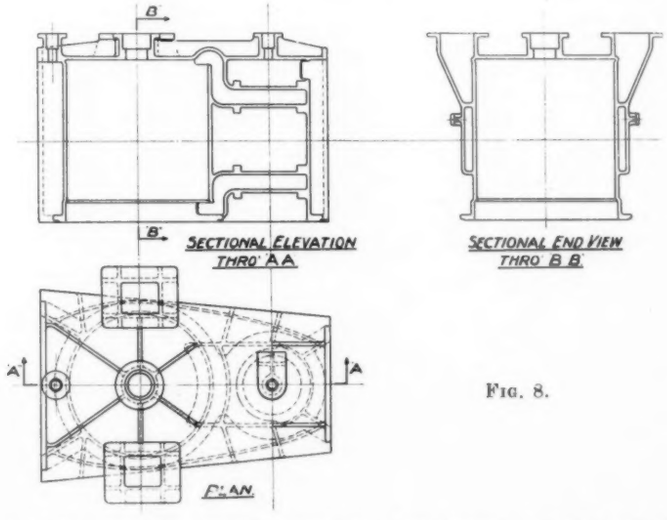


Fig. 8.

When completed, the centre lines should be carefully marked off on this face.

A section of the pattern forming the flange, having a uniform thickness all round is then put in place, and the stripping piece on the board should be withdrawn so that the bottom joint can be strickled, and this board removed. The main core board can now be set, and the

to allow freedom to carry out smooth working in setting operations and in closing or assembling. As in the case of the plates already described, this one also has lifting lugs, which are so arranged as to distribute the load evenly in any reasonable position and at any time. When casting the plate, the necessary holes have to be cored as would be required for bolts passing

through the plate for bolting purposes, and also for vents for the escape of gas, etc. Six or more 1-in. wrought-iron bars are cast in, near the top and bottom edge of the plate to facilitate the fastening to the plate of any grids that may have to be secured at certain positions. This is done by inserting the bars in the cores made in the plate.

Template Details

As shown in Fig. 9, the parts required from the patternshop for these two sections or sides of the mould, are two templates, having their working faces the same size and shape to correspond with that between the flanges of the

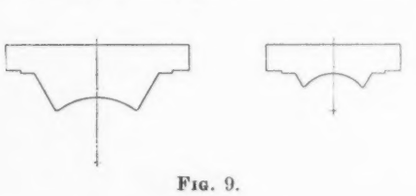


Fig. 9.

cylinder. They are held in position by two vertical flanges coinciding with the valve face and receiver end of the cylinder. All other projections are placed on bars which extend across the mould face, and which are securely fastened in place and marked. Drain bosses and supporting webs to be cast on flanges are placed in their correct positions on the template. This frame is quite like a corebox of skeleton design, and can be easily set with the aid of a spirit level, or checked at any time while in use. The most convenient method in setting such a job is to have a bar so placed on the outside of the templates that a level laid across them will immediately show if alignment is correct. The frame is then laid on the plate the required distance apart.

The length of the templates is the same as the side plate, and this being 2 ft. longer than the cylinder it accommodates a 12-in. bearing or joint at each end of the mould. In cutting the template at least 6 in. of wood should be left to give strength on frame to strickle the face of the joints and moulds. In building the procedure is, as is common in loam moulding, to bolt the built-up material, with the aid of grids, to the lifting plate, where vents or cores have to be placed. This can be simply accomplished owing to the open and easy access to this mould section. When this section has been strickled up, the templates and other projections removed and dressed, it is then allowed to stiffen before being dried and finished in the usual manner.

The receiver end section is carried out in the same manner but it is simpler and a smaller part to mould. Two templates are required (as shown in Fig. 9) the exact size and shape to coincide with the inside wall of this part of the cylinder, and like the sides are the depth of the cylinder apart. They are held together with bars, the bottom one of which is made longer to enable the setting of frame to be accomplished easily over the plate on which it is built. Stool brackets or other such projections are placed on bars as on the side frames, previously described. The lifting plate for this section will differ slightly in design as compared with the one used for the side plates. On this plate wrought-iron handles replace the lugs: these handles should be designed similarly to a semicircle and made from 1¼-in. dia. bar, and when designing them they must be sufficiently large to allow the hook of a lifting chain to pass through it without difficulty. Fig. 11A shows the end plate.

It is advantageous to have one or two large holes cored in the plate, as this allows a certain amount of freedom to fasten up and seal the core-vent arrangement of jacket cores. Other smaller holes, for bolts, etc., should be cored in such positions as found most convenient. Obviously it will be necessary to have two 1½-in. lifters inside the plate to enable it to be lifted on end, and also to balance the load in closing this section. With the slide valve face as with the piston valve chamber the method of building is the same, but the assembly is slightly different. The slide valve face is fastened on to the end moulding-plate complete: this, by the way, is common practice on the North-East coast.

In assembling the piston valve the cores are built to place as is indicated by the centre line already drawn on the main core. It is checked by a side template cut exactly and marked off to the centre line on the main core, and from Fig. 8 the advantage of this method can readily be appreciated, as thicknesses, etc., can all be inspected, thereby preventing any mishap which might occur if one could not see each core as the job was being built.

Method for Top Part

In respect to the top part the method which should be adopted is to set up a cross and spindle, and a level bearing is strickled up. Its size is approximately 18 in. larger on each side than the flange of the cylinder. It is essential that the bearing is level, as from this the pattern is set. In this case the pattern would be a complete section of the top cylinder flange, including all stools, bosses, etc., attached to it in the usual manner. All screws, nails, etc., should be driven in from the bottom side of the board, as when this is done, the whole thing can be turned over after it is built. This ensures both a good lift and top part.

The pattern is then set up on the bed previously prepared, the centre lines of the pattern and of the bed coming into line. The moulder can be confident that, providing sufficient weight is placed on top of the pattern, it will remain in its true position. As an additional check, the spindle which is still in a central position can be used to determine any dimension in respect to branches, brackets, bosses, etc.

The building of the top may now be started, and at this stage the position of the gate pins marked off, also any risers or vents passing through the lifting plate. The lifting grid may

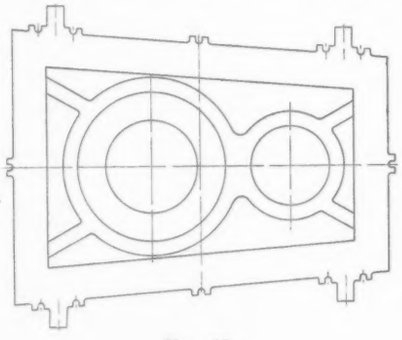


Fig. 10.

be tried in place, fitted, and all pins set to their correct positions. This action is built up to the top of the stool flange, so as to allow a joint to be made if required. In the event of such a joint being found unnecessary, it is considered good practice to complete these stool flanges before finally placing the top plate. In some instances it may be found more convenient, or even necessary, to have block cores or a drawback round the stools to allow closing and placing of stool cores. With this now completed, we proceed to assemble the parts of this cylinder and mould as follows.

The bottom plate is set on a suitable site, and this, from experience, would be a pit of depth sufficient to allow ease in casting. If, however, such a site is not available, a job of this description can be cast almost as easily on the floor (since ramming is not required), with the aid of a suitable scaffold.

Bottom Section

It is essential that the bottom section be set absolutely level, and in any convenient manner secured, so that movement cannot take place during the assembly of the various remaining sections or while being cast. When the job is finally assembled, it should be inspected for injury, the centre lines again checked, the cores

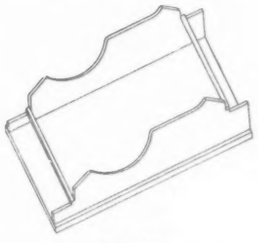


Fig. 11.

Fig. 11A.

forming the valves placed in position, and each proved with the aid of the template and depth stick, the vent connections properly arranged in the placing of each core until the top one is in position. This can be easily visualised by the practical moulder.

The receiver end, if found in order after a careful inspection, is then placed in its true position with the aid of the template already used for the valve end.

The side sections, which have previously been prepared, should now undergo final inspection; if found correct, they should be turned up, one at a time, and placed in position. When in position, it is advisable to check that the prints of the cores correspond with those on the other sections. If there be any doubt that possible injury has occurred during this operation, then the section should be lifted, re-examined, and, when found entirely satisfactory, replaced in its true position, on which there should also be a final check. The side section remaining may now be set, and, when found correct, the cope and the mould should be bolted together. By adopting this procedure, no breakages can possibly take place without its becoming apparent, and therefore a good job can be guaranteed. Vents can now be made up with absolute safety, and by the use of mirrors the complete mould can be inspected in a comparatively short time.

The top section being previously prepared with cores in position, can now be tried to place, the thickness checked and, if found correct, it can be bound to the bottom, along with the securing of any vents to be brought through the top part.

The job is then completed, when, having formed the head in the usual manner, the casting operation then takes place. The moulder's art should, and must, be demonstrated by the result of a good, sound and perfectly-shaped casting. In conclusion, the author wishes to express his thanks to Mr. J. T. McNair for his assistance in preparing the Paper, and for preparing the drawings from which the slides had been made.

U.S Output of Aluminium

According to a report of the United States Bureau of Mines, the production of primary aluminium, by the Aluminium Company of America amounted to 119,295,000 lbs. valued at $22,070,000 in 1935, as compared with 74,177,000 lbs., valued at $14,094,000 in 1934. The 1934 output was the lowest for any year since 1922 and the 1935 output was only 52 per cent. of the high record of 229,035,000 lbs. established in 1930.

Some Tests on Tin Bronzes at Elevated Temperatures[1]

By J. W. BOLTON

(Extract.)

In this Paper there are presented data on "creep" and some other effects of exposure to temperature under sustained loads, on alloys specified in the Society's Standard Specifications for Sand Castings of the Alloy: copper 88 per cent., tin 8 per cent., zinc 4 per cent. (B-60), and in Standard Specifications for Steam or Valve Bronze Sand Castings (B-61).[2] For convenience these two alloys will be referred to as alloys B-60 and B-61.

The alloy B-60 is known to the trade as 88-10-2, 88-8-4, Admiralty gunmetal, etc. The alloy B-61 is termed steam or valve bronze. It is very widely used in pressure-containing parts subjected to moderately elevated temperatures. Alloy B-60 and related alloys also are used to some extent in industry for such applications.

Recent revisions[4] of Specifications B-60 and B-61 call for the following minimum room-temperature physical properties:—

	Alloy B-60.	Alloy B-61.
Tensile strength, tons per sq. in. ..	16.9	15.2
Yield point, tons per sq. in. ..	7.1	7.1
Elongation in 2 in., per cent. ..	22	22

Note.—These minima are somewhat higher than those specified in the 1933 "Book of A.S.T.M. Standards," Part I.

The object of the work which we conducted was to determine the limiting temperatures within which alloys B-60 and B-61 may be safely applied in pressure-containing parts by ascertaining the ability of these alloys to sustain loads at elevated temperatures and their structural stability under conditions of temperature and loading; that is, "creep" characteristics and freedom from or tendency toward embrittlement, as the case might be. Previous creep tests[5] indicate that alloy B-61 had the better load-carrying ability of the two alloys, and probably could be safely used at temperatures up to 288 deg. C. in conservative design.

Casting Procedure

For each alloy, a number of bars was cast from a ladle. Green-sand moulds were used; the reduced section of the bars was about 0.53 in. in diameter as cast; and the risers were in the gating system. (That is, we did not use the heavy "Webbert-type" riser along the top of the bar, although bars were cast in the horizontal position.)

Composition

The alloys tested had the following composition:—

	Alloy B-60.	Alloy B-61.
Copper, per cent. ..	87.60	87.14
Tin, per cent.	10.18	6.22
Zinc, per cent.	2.02	4.61
Lead, per cent. ..	none	1.83

Impurities are held to low limits.

Room Temperature Tests

The following are results of tests conducted at room temperatures:—

	Alloy B-60.	Alloy B-61.
Diameter tested, in.	0.505	0.505
Tensile strength, tons per sq. in.	21.0	16.8
Yield point, tons per sq. in. ..	9.1	7.7
Elongation in 2 in. per cent. ..	35.4	34.3

Tests on Creep Bars

Bars 0.357 in. in diameter were used. These were cut from bars 0.53 in. in diameter as cast. The temperature, uniformity, calibration, loading accuracy, etc., complied with the A.S.T.M. Tentative Method of Test for Long-Time (Creep) High-Temperature Tension Tests of Metallic Materials (E 22-34 T).[6] The Lunkenheimer Company equipment and calibration methods have been described previously.[7]

After testing in creep, the bars were removed from the furnaces, and tested in tension at room temperature.

After test at 260 deg. C. at loads within or slightly above a limiting creep rate of 0.1 per cent. in 10,000 hrs. (4.0 tons per sq. in.) *there is no loss in strength or ductility* shown by subsequently testing at room temperature. (This loading, or stress, is far above that contemplated in valve design.) At loads producing rather rapid creep appreciable loss in strength and ductility results. At 288 deg. C., at a load (2.2 tons per sq. in.) producing a creep rate of 0.28 per cent. per 10,000 hrs., some loss in strength and ductility results, but nothing like that observed at a lower loading (1.8 tons per sq. in.) in the case of alloy B-60 (88-10-2). It is readily conceivable that at lower loads alloy B-61 at 288 deg. C. may be unimpaired in strength and ductility. At 319 deg. C. there is a very great loss of strength and ductility, probably due as much to exposure to temperature as to the choice of a load producing a relatively rapid creep rate. It may be mentioned, however, that the coarse-grain formation produced in alloy B-60 (88-10-2) at 319 deg. C. was not noted in alloy B-61.

Comparisons of Alloys B-60 and B-61

There is a fundamental difference between alloys B-60 and B-61 in their behaviour under temperature. At 260 deg. C., and probably even at 288 deg. C., there should be no hesitancy in specifying alloy B-61 for stresses within those required to produce 0.1 per cent. secondary creep rate per 10,000 hrs. It appears that the use of alloy B-60 at 260 deg. C. should be confined to applications where design is conservative and stresses are low. In no case does it seem conservative engineering practice to employ alloy B-60 at temperatures above 260 deg. C.

The question may well be asked why there should be this great difference in behaviour at temperatures around 260 to 288 deg. C. The tin in alloy B-61 is present in solid solution with the zinc and copper. In alloy B-60, in commercial casting practice, some of the tin is present in the alpha-delta eutectoid form, as isolated tin-rich particles. The practical foundryman, familiar with the phenomenon of "tin sweat," will have little difficulty in visualising the possibilities. Whatever speculations may be indulged in, it is evident that absence of a tin-rich component (as found in higher tin alloys) is advantageous.

Microscopic study was made on the samples removed from test at 319 deg. C. and on other samples. The sections chosen for micro-examination were in the heads of the test-bars, where distortion is at a minimum. The general microstructures of alloys B-60 and B-61 as cast are well known. Alloy B-60 has a cored structure, essentially a solid-solution matrix, with small particles of the tin-rich alpha-delta eutectoid—alloy B-61 has a cored structure, essentially a solid solution, with small lead droplets, but no apparent alpha-delta eutectoid. In alloy B-60 the alpha-delta eutectoid is much harder than the matrix.

Samples of alloys B-60 and B-61 tested at 260 and 288 deg. C. also were examined. Alloy B-60 (88-10-2) showed marked tendency towards network formation in the sample tested at 260 deg. C. and very distinct network formation at 288 deg. C. Alloy B-61 showed no formation at 260 deg. C. nor were such formations perceptible at 277 deg. C.

From the above studies it is evident that the alpha-delta eutectoid when present acts as an embrittling agent at elevated temperatures, and bronzes containing this eutectoid should be viewed with suspicion for applications at 260 deg. C. and above. On the other hand, bronzes free from this eutectoid and which do not precipitate this eutectoid when held at elevated temperatures do not show embrittlement and should be regarded as a separate species. At 260 deg. C., or probably somewhat above, alloys with about 6.2 per cent. tin and 4.6 per cent. zinc do not form this eutectoid. At 319 deg. C. such bronzes show precipitation of a small amount of the eutectoid. With tin content constant, the formation of the eutectoid may be prevented by some restriction of the zinc content (say to 4 per cent.) or by the addition of small percentages of nickel (say about 0.7 to 1.0 per cent.). In commercial experience, at room temperatures, the eutectoid is not found up to 6.5 per cent. tin (or possibly slightly above) when the zinc content is within the limits of Specifications B-61.

Although the samples studied had been subjected to effects of stress as well as to effects of temperature, it is the author's opinion that the marked changes noted in microstructure after creep testing are due primarily to the exposure to temperature.

Conclusion

It is the author's opinion that bronze of the alloy B-61 type is very well suited for use at 260 deg. C. and possibly up to 288 deg. C. It is unsuited to applications where the temperature of the metal structure reaches 319 deg. C. The design stress at 260 deg. C. should be limited to 2.2 tons per sq. in. It has been shown that at 260 deg. C. alloy B-61 has a "limiting creep strength" (based on that stress which produces a rate of flow less than 0.1 per cent. in 10,000 hrs. after the first 500 hrs. of creep tests, running up to 2,100 hrs. duration) of about 3.6 tons per sq. in., or about 1.6 times the recommended maximum design stress. These results suggest that it would be in order to indicate this temperature limit as practical and conservative, in an early paragraph in Specifications B-61.

In case of bronzes containing the alpha-delta eutectoid including the compositions contemplated by Specifications B-60, and especially the high-tin alloy 88-10-2, the tests run indicate that at 260 deg. C. the load-carrying ability is lower than that of alloy B-61, and there is distinct evidence of embrittlement. Microscopic study suggests that this embrittlement is caused by the formation and to some degree possibly to penetration of the eutectoid along grain boundaries. This condition becomes very apparent at 319 deg. C. It is the author's opinion that from a code and specification viewpoint the use of such high-tin alloys probably should be confined to 254 deg. C. and permissible stress of 2.2 tons per sq. in. at that temperature. He is cognisant of the fact that such alloys have been used with apparent success. It is possible that despite the apparent operating temperatures, the actual temperatures at the metal structure may be lower than the operating temperature.

Reopening of Blast Furnaces

It is expected that in the near future the South Durham Steel & Iron Company, Limited, will restart their Seaton Carew blast furnaces, which have been idle for 10 years.

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[1] A Paper presented to the American Society for Testing Materials. The author is Chief Chemist and Metallurgist, The Lunkenheimer Company, Cincinnati, Ohio.

[2] 1933 "Book of A.S.T.M. Standards," Part I, p. 608.

[3] *Ibid*, p. 589.

[4] "Proceedings, Am. Soc. Testing Mats.," Vol. 34, Part I, pp. 1260, 1259 (1934); also 1934 "Book of A.S.T.M. Tentative Standards," pp. 1188, 1187.

[5] "Symposium on Effect of Temperature on the Properties of Metals," published jointly by the American Society for Testing Materials and The American Society of Mechanical Engineers, pp. 361—368 (1931.) Available as separate publication.

[6] "Proceedings, Amer. Soc. Testing Mats." Vol. 34, Part I, p. 1223 (1934); also 1934 "Book of A.S.T.M. Tentative Standards," p. 1147.

[7] H. Montgomery and J. W. Bolton, "Furnaces for Elevated Temperature Tests." "Metals and Alloys," June, 1934, pp. 127-128.

Welsh Foundrymen's Annual Meeting

MR. SOUTHCOTT'S PRESIDENTIAL ADDRESS

The Annual Meeting of the Wales, Monmouth and West of England Branch of the Institute of British Foundrymen was held at the Great Western Hotel, Cardiff, on March 21. Mr. C. E. Richards presided.

The following officers were elected for the year:—

President.—Mr. S. Southcott (Briton Ferry).
Senior Vice-President.—J. P. Galletly (Cardiff).
Junior Vice-President.—Mr. A. S. Wall (Cardiff).
Hon. Secretary and Treasurer.—Mr. J. J. McClelland.

The retiring President was thanked for his services to the Branch on the proposal of Mr. Hood Williams, seconded by Mr. Kinsman, and carried unanimously, and in response Mr. Richards said that he hoped Mr. Southcott would be as happy in his office as he himself had been.

Mr. McClelland presented a statement of accounts, which showed that membership was on the increase, and that the numbers now totalled 70. Another effort was being made to get more activity in Llanelly and also at Bristol. It was agreed to arrange a summer outing, details being left for the Council to arrange.

PRESIDENTIAL ADDRESS

At the conclusion of routine business, the new President took the chair, and delivered his Presidential Address, in the course of which he said:

Mr. Richards and Gentlemen,—I wish to express my thanks for the honour you have conferred upon me by electing me to the Presidential chair for the ensuing year. Your kindly thought is more appreciated in view of the fact that our Branch, whose main activities are centred around Cardiff, certainly calls for a President from that area in preference to any other. In accepting office, I realise that I have to make every endeavour to follow successfully in the footsteps of those who have discharged their duties with great credit, not only to themselves, but also to the Institute.

Industry calls loudly for the services of our Institute; the demand for something concrete is greater than ever, and our Institute presents what is needed. The operations of the Institute ever since its inception have always proved successful. Prior to its birth there existed in the trade nothing but muddle and misunderstanding; shop practice was sadly lacking in efficiency; in the non-ferrous departments secret and pet mixtures held the sway, and there was no proper system of control; steel castings were on the fringe of commercial stability—hence the urgent need of the Institute. This may appear to be a bold statement, but I am not making it without justification, for we find in The Foundry Trade Journal of May 18, 1904, the following special appeal:—

"If we are to keep in the front line of progress we must leave behind the indifference to scientific fact and higher knowledge which has too long beset us.

"That the industrial future lies with the people most highly trained in the arts and sciences applicable to practical work, as well as in practical work itself, there is no manner of doubt."

Since that time the Institute has grown very rapidly. Notable changes have taken place; systematic control has operated to a far greater extent than is realised. Non-ferrous metals have become so commercialised that it is possible to procure any and every mixture to answer all demands. Steel has emerged into commercial daylight, so much so that in many instances it is preferred to cast iron. If one seriously probes into the causes of the decline of the iron trade one has not to look much further than the steel trade for an answer. I do not claim that the Institute has been wholly responsible for this, that nobody deserves greater credit for the industrial progress. What then has been chiefly responsible for this progress? I would venture to suggest that the Branches, with their periodical lectures and reading of scientific and practical Papers on various subjects, have contributed largely. The Institute has afforded a means for such scientists as Prof. J. H. Andrew, Mr. J. G. Pearce and Prof. W. R. D. Jones to furnish the industry with specialised data, and has thus co-operated in the attainment of knowledge and efficiency.

Work of the Technical Committee

The services rendered by its Technical Committee have proved of enormous value, and we cannot fail to appreciate the labour put in by its members. We have the sub-committee dealing with sands and refractories—one of the most important questions with which foundries have to contend. The information disclosed by this section is of such importance that it should be kept constantly to the front in all foundry discussions. Owing to the immense amount of work and concentration involved, this committee has been sub-divided into two separate bodies—one to deal with sand and the other with refractories. The other sub-committees with their all-important subjects render invaluable services to the industry. Unfortunately, time does not permit of a review of their work.

I also observe that the sub-committee on Costing has issued two preliminary reports. Excellent though these are, divergent opinions appear to be expressed in regard to them. It is of paramount importance that these reports should receive the attention they deserve, and I hope everyone concerned will draw from them food for thought.

The time has arrived when price-cutting, with its tendency to cripple and eventually destroy all who come into contact with it, should be resolutely tackled. I have seen fairly modern foundries become derelict through the working of this pernicious agency. If the reports referred to will result in a better understanding (and I think they will), then we may confidently look forward to a beneficial change. However, whilst the necessity arises for strict observance of costs, we must guard against this becoming a fetish, and quality in material and workmanship sacrificed for cheapness. There is an old saying (and a true one) which runs: "Quality will be remembered long after costs are forgotten."

In 1904 our membership was well under the 100 mark, its influence was limited, and its activities few. Since then its growth has been exceedingly rapid, and to-day we find that its interest embraces every phase of industry. It has attained international repute, and members are found in every country of the civilised world, and its ramifications are extending to vast proportions—a glowing testimonial to the self-sacrifice of its members. Every technical association in the world recognises and utilises its work, and being in such close co-operation with kindred Institutions, it shoulders its responsibility with dignity.

Trade Prospects

Turning for a moment to the position of the trade in our country, though there are no available statistics that can be quoted in regard to Wales, I think we can claim some satisfaction from the fact that the past year showed a great improvement on previous years, and this can only be realised by a perusal of the Board of Trade Returns. It is an axiom that exports will give a direct reflection of the home trade. Taking the year 1920—which was considered the best year since the great war for new orders, especially in electrical engineering—we find that the growth during the past three years has been colossal. In 1934 the figure was roughly 66⅔ per cent. of that of 1920; in 1935 it was only 5 per cent. below 1920, and this in spite of the fact that the three years preceding 1934 were the lowest on record. In the export trade the revival has taken even greater strides. In 1932 foreign orders were only 66⅔ per cent. of what they were in 1920—in 1934 they were 20 per cent. above, and in 1935 they were 33⅓ per cent. above. During the past three years exports have shown a very marked recovery in almost every section. The total value of machinery exports in 1934 was £5,500,000 above 1933, whilst the figure for 1935 was nearly £3,000,000 above 1934. The iron and steel trade, with which many engineering firms are connected, shows a similar position; the 1935 returns reveal an increase of £2,000,000 above 1934, £7,500,000 above 1933 and no less than £9,000,000 above 1932. The returns of January and February of the current year show an increase on January and February of 1934. These increases take place when in almost every direction imports are far below in the years mentioned.

The Rôle of the Foundry

In view of these statistics, it is quite evident that our country is more than holding her own in the world's markets. It may be asked what this has to do with the Institute of British Foundrymen. I submit that the figures quoted are a direct reflection of what the foundry has to meet in the future. What steps do we intend adopting with a view to securing the advantages offered by the present boom? In many parts of the country efforts have been made to meet the conditions. In his article in the Journal of January 9, 1936, Mr. Lunt states that one foundry has spent £160,000 on extensions and new plant, and additions on a large scale have been carried out by several other companies.

Up to a few years ago mechanisation of the foundry was the laughing stock of the members of the trade; to-day it has become an accomplished fact; it is still developing, and the time is not far distant when it will govern the chief methods of production. It is not suggested that foundry mechanisation on a large scale in Wales will bring prosperity to all, but I personally realise that unless we want the industry in Wales to stagnate, progress must be made towards better and fuller equipment. A move in the direction indicated involves special circumstances and people, but as an Institute we should throw open our doors to all connected with the trade, not only to give but also to obtain advice on these questions in order to prepare our members for the new positions that have arisen.

To the young men I would say, if you want to succeed in your trades take advantage of the opportunities offered by the Institute; enter the technical classes conducted by the various colleges, for in future the industry will demand men with knowledge and ability for all executive positions. Science is proving that few of us use more than one-tenth of our potentialities. This condition applies physically, and mentally. Do not allow your talents to lie unused; do not wait until an emergency comes along which forces you to do your best; act now. "To thine own self be true, and it shall follow as the night the day, thou canst not then be false to any man."

Mr. J. H. Chapman has been elected chairman of Ibbotson Bros. & Company, Limited, Globe Steelworks, Sheffield, in succession to the late Mr. F. J. Talbot.

How to Reduce Coremaking Costs

Mr. N. P. Newman's Paper on this subject, read before the London Branch of the Institute of British Foundrymen and printed in our issue of March 26, created an interesting discussion. It was opened by the chairman, Mr. V. Delport, who is also Convener of the Institute's Costing Sub-Committee. He said that his Committee was on the point of considering costs in the core department, and he welcomed the Paper particularly because it contained much information which would help the Sub-Committee in its work. He expressed the hope also that many points equally helpful to the Sub-Committee would be raised in the course of the discussion.

Core Drying

Mr. John A. Smeeton said that his interest in the Paper had been enhanced by the fact that he had been partly responsible, with Mr. Newman, for the installation of part of the core-oven plant described. One was impressed by the care which undoubtedly was being exercised there in the production of every individual core, no matter how made, and by the care taken to ensure that every individual worker in the core department and the foundry was supplied with really efficient tools. The core department of Messrs. Newman, Hender, Limited, occupied a comparatively small space in relation to the enormous output. When the organisation of the foundry was discussed, the problem of the production of hand-made or machine-blown cores was examined most thoroughly, and Mr. Newman and his father had investigated almost every known type of coremaking machine on the market. Mr. Smeeton recalled having seen four different types of machines undergoing very stringent tests in the coreshop, the tests resulting in the adoption of those which were most efficient. The part of the plant in which Mr. Smeeton was most interested at that time was the drying plant. Being a furnace man, by instinct if not by profession, he had eventually persuaded Mr. Newman and his father, after many days' discussion, to adopt a batch-drying system. Cores could be dried efficiently only by being able to subject them to just the amount of heat required for that purpose; any over-drying or under-drying was eventually bad for a core. That was why he had emphasised the necessity for batch drying, by means of which the small cores of comparatively even weight and size could be dried in one oven and larger cores in other ovens, thus eliminating waste of time and heat, and the unnecessary opening and closing of doors, for one could calculate to within seconds the time required to dry cores stoved in this manner efficiently. The cost of the drying had been reduced, he believed, to the almost irreducible minimum. He had been impressed particularly by the cleanliness of the whole plant and system. There was no dirt and no excessive heat to disturb the workers, the whole atmosphere of the plant was clean and reasonably warm or cool according to the weather, so that the workmen had every encouragement to work well. Each of the girls, boys and men employed there were individually interested in every piece of new machinery and plant installed; in other words, they felt as much interest in the success and efficiency of the plant as did Mr. Newman himself.

Many developments had been made in regard to the transportation of cores since Mr. Smeeton was last at the works. The company had not over-mechanised, although there was a tendency to over-mechanise in many classes of industry nowadays, but had used machines to eliminate unnecessary labour and seemed to have achieved the highest point of efficiency. It had been said by many members of the Institute from time to time that nearly all the Papers presented at meetings dealt with mass production, and did not help the jobbing foundryman—and to a very large extent that was true. It was very difficult to mechanise a jobbing foundry, whether in regard to the making of cores, the mechanical handling of sand or the machine-making of moulds or of cleaning castings. It seemed impossible to put down six or eight batch ovens for an ordinary normal jobbing foundry, using cores varying in weight from ¼ lb. to 10 lbs., and to expect the average founder to use one oven for the small cores and another for the larger ones. The majority generally put their cores of different sizes into one oven and trusted to luck that the small ones would not be over-dried and burned or the large ones under-dried, or they would leave them all in the oven until the biggest cores were well dried, and would hope that the small ones had not disappeared altogether.

Mr. Newman's Paper was well thought out and was based on actual practical experience. Any who wished to see a really highly-efficient, low-cost coremaking plant would be well advised to visit the works of Newman, Hender—Mr. Smeeton felt sure that the company would be pleased to welcome visitors—for the plant and organisation represented almost the last word in economical and efficient production.

Mr. Newman exhibited some examples of cores and coreboxes illustrative of the work carried out by his company. One was a cock core, machine-blown, produced at the rate of five per min., by two operators. Two others (for a small valve and a small manifold) were produced at the rate of four per min. Three others were ordinary hand-made cores, in aluminium coreboxes. He added that those small cores were not indicative of the whole of the company's core output, but had been selected as examples merely by reason of their ease of handling.

Used Sand Reclamation

Mr. F. Gentles, commenting on a statement that up to 30 per cent. of old sand was used in core mixtures, asked whether a great deal of trouble had been experienced, after milling it down, due to small pellets of old sand appearing in the surface.

Mr. Newman replied that there was definitely a danger, when using old coresand, of the inclusion of small pellets in the surface, and possibly there were signs of them in the hand-made cores. The company exercised very great care indeed in regard to the quantity and type of old coresand used in the mixtures, but they used practically all the spilled or left-over sand, which, to all intents and purposes, except for having lost its "life," was new sand. Sand returned from the mechanical shake-out was inspected and all burned sand was taken out, the remainder being put through a Herbert mill and subsequently added to mixings in proportions up to as much as 30 per cent. In some cores, where the fineness requirements were a little more stringent than in others, only 20 per cent. of old sand was used.

Mr. V. C. Faulkner (Past-President of the Institute and of the London Branch) asked why founders in the West of England used large quantities of red sand from the Midlands. He had in mind particularly that this type of sand contained clay, and that, according to usually accepted theories, a greater quantity of core oil was required for bonding in those circumstances than when using clay-free sands.

Mr. Newman replied that when he was in charge personally of the foundry he had tried 20 or 30 similar types of sand, but had never been able to get so good a finish with any of them as with red sand from Nottinghamshire. For a whole year he had used a sand from the Birmingham area, but had had to discontinue its use because he was not getting anywhere near the results obtained with the former. He could not say whether these red-sand cores required more core oil than other types, but the proportion of binder used in his core-sand mixture worked out at about 4 per cent.

Corebox Making

Mr. A. S. Beech (Past Branch-President) asked how the coreboxes were made.

Mr. Newman replied that first the company worked from a drawing and made a master wood corebox; that allowed for double contraction—contraction of the aluminium casting used for the corebox and contraction of the iron, gun-metal or other material of which the finished casting consisted. Generally the contours of the coreboxes were scraped and rubbed by hand, and the faces were all machined. All coreboxes were fitted with renewable hardened-steel dowels or pins and bushes, those dowels and bushes being important factors in ensuring the accuracy of the cores. As an average, the machining allowance on automatic work on valve bodies was considerably less than $\frac{1}{16}$ in. In many instances, if there were the slightest overlap, the whole of the castings would be returned, and, in general, there must be very fine limits in core allowances and overlap.

Mr. Gentles asked whether the steel pins would give way when used in aluminium.

Mr. Newman replied that the steel pins were matched to fit corresponding renewable steel bushes. Nearly all the coreboxes were also made with spare lugs so that the pins or dowels could be changed round to different places in the boxes. Some 10,000 or 15,000 cores could be made before it was necessary to do anything at all to the pins and bushes.

Mr. Gentles asked if there were any vent in the cock core which had been exhibited.

Mr. Newman said there was no vent and no wire. At the same time, one should be able to blow through it.

Surfacing Cores

Mr. J. D. Hotchkiss asked whether Mr. Newman blacked the cores in order to produce the very fine surfaces, and, if so, how he applied the blacking—whether the core was hot or dry when the blacking was applied.

Mr. Newman replied that no blacking had been used in the coreshop since he had been connected with the company. In one particular type of core, for motor parts, an extra-fine finish was required, and for that he used a Kentish sand, which had a very fine grain, and made a special mixing; that was the only special mixing used by the company. Kentish sand was rather expensive by the time it reached the West of England, but by its use he obtained results as fine as any that he had ever been able to obtain by the use of blacking. On one occasion he had melted and boiled a proprietary semi-solid core compound in water to make a wash, and had sprayed the cores with it, so that when they were re-baked they had a very hard skin. In that case the cores (without the addition of the wash) had been fragile and were rather apt to give way under the weight of the metal, and the purpose of the wash was to protect the cores against the action of the metal rather than to produce a special finish.

Mr. A. E. Perry, referring particularly to a valve core that had been exhibited, asked if irons of any sort were used.

Mr. Newman replied that in practically all fragile hand-made cores, irons or core wire were used. The method was to fill each half of the box, then to bed the core wire in position, leaving the box a little "proud" when the two halves were closed together, and to put them in a vice.

Mr. Perry said he had found that a diamond-shaped iron was best from the point of view of squeezing the halves together.

Mr. Newman agreed that that gave good results, and said he had also used a very large quantity of piano wire, which was very good.

Mr. Faulkner asked how wire was put into machine-made cores.

Mr. Newman replied that he never put a wire into a blown core. It was surprising how very strong the machine-blown cores were, even though they had no reinforcement whatever.

Shaped Carriers

Mr. Wallington asked whether the carriers for the cores were shaped to the cores.

Mr. Newman replied that they were. The same method was used for making carriers as for making coreboxes, there being first a master wood carrier, from which were made metal carrier patterns, which in turn were used for making quantities of aluminium castings, subsequently being cleaned up. An important consideration in regard to the carriers was that the cores must be held at the bottom or must bear on the bottom, but the carriers were made to clear away slightly from the sides of round cores in order to allow the coremaker some freedom when turning them out. The holes for taking the pins on coreboxes must be in correct registration with the drier; otherwise, when the drier was on the top of the half corebox, with the core in it, one was apt to slop it over and push down the sides.

Mr. Wallington said he supposed it was necessary to use a few hundred carriers.

Mr. Newman replied that there were at least 250 carriers for each type of core, if it were a regular line.

Costing Reclaimed Material

The Chairman commented that the use of old sand necessitated, of course, the use of special plant and equipment, and the capital cost and maintenance of that plant and equipment must be a very serious consideration, particularly in the case of a small foundry which was not operating on mass-production lines. The problem of quantity production *versus* the production of smaller quantities of various types of castings was very difficult from many points of view, and the greatest difficulty was experienced in finding a uniform costing system applicable not only to the quantity-production foundry but also to what was generally termed the jobbing foundry. Many schemes mentioned in Mr. Newman's Paper and in the discussion were perfectly justified in the case of a quantity-production foundry, but one might not be able to justify their application to a foundry producing a large variety of castings of different sizes and shapes. Some castings needed practically no cores at all, whereas others needed a quantity of very intricate cores. In view of the difficulty of that problem from the point of view of costing, he was particularly anxious to hear the views of representatives of the small foundries.

Although Mr. Newman appeared to have indicated a preference for the employment of female labour for coremaking, Mr. Delport said he had read recently that a plea was being made in a neighbouring country for the displacement of girls from the coremaking departments of foundries in order to make room for the older men who were no longer able to carry on their original jobs but who possessed quite a lot of experience of coremaking and foundry work generally. We might have to consider that problem in this country, for there was still a good deal of unemployment.

The suggestions made by Mr. Newman with regard to piece rates seemed to be almost the soundest that Mr. Delport had heard so far. He asked what was the basis on which the author's company allocated the overheads in respect of the core department—whether on the labour or the time basis. From a remark made by Mr. Newman it seemed that the cost of the drying ovens was a departmental overhead and that the allocation was made on a core-tonnage basis.

Allocation of Overheads

Mr. Newman said that the practice of his firm was to cost on quantities; he had given in the Paper a cost per ton, because he had thought that that would be more understandable. The overheads were allocated as a fixed percentage on productive labour, which productive labour was based on the piecework wages. Each year, and usually each half-year, it was his job specifically to allocate actual expenses to the coreshop and to find out whether the percentage on which it was working did cover the actual expenses. When preparing the Paper, the word "costs" had caused him considerable difficulty. Originally he had been trained as an accountant, having spent five years in a chartered accountant's office in London, and when he had first joined Newman, Hender he had been concerned purely with accounts. He had also to fit himself for a general supervisory position, and had taken his practical training on the foundry side. At first he had thought of writing the Paper mainly from the accountancy point of view, the importance of which could not be overemphasised, especially in a business such as that of his own firm, where an order for valves weighing 2, 3 or 6 lbs. might be lost on a margin so small as one halfpenny each, and sometimes even less than that. Therefore, accurate costing was extremely important, not only in the coreshop but throughout the foundry, the machining departments, the offices and the selling organisation. However, he had decided not to devote the Paper entirely to accounts, but to cover also his small knowledge of foundry work, particularly coreshop work.

Mr. Smeeton asked what was the average percentage of faulty cores, between the commencement of the making of the cores and the using of the cores in the moulds.

Mr. Newman replied that in the case of the ironfoundry—and not only in the foundry itself, but right through the machining operations, and, most important of all, through the test, for practically every casting was subjected to pressure test by means of air, water or steam—the average wastage had never exceeded 5 per cent. over all classes of production. In respect of many lines, especially pumps, the total rejections had been reduced to slightly under 2 per cent. Some four or five years ago it was found that the production in the company's foundries was considerably in excess of the quantities which the machining side of the business could absorb, and he had adopted the procedure of offering castings to the trade. Amongst other things, the company had started on motor work, which was then quite new to them, and for a time the percentages of rejections were greater than the figures he had mentioned. As the result of experience, and by some selection of jobs for outside firms, they were able to reduce the percentage of rejections to a figure somewhere near that experienced in their own class of work. Previously they had specialised almost entirely on pressure castings, which in many forms of production called for rather special care and involved the use of special irons or special bronzes, and they knew fairly well the types of irons or bronzes to use. They had not known so much about the classes of metal used for products for the motor and electrical industries, and so on, and had had to gain their experience in the making of such products.

Mr. Perry said that in his district the price of the red sand was more than twice that of ordinary sand, and he asked what was the relation of the costs of this and the ordinary sand at the works of Newman, Hender. He had tried the former, but had discontinued its use because it did not produce a better green-bonded core, whereas the cost was greater.

Mr. Newman replied that the red sand from Nottinghamshire was expensive in his district, mainly by reason of the cost of carriage. Kentish silica sand was even more expensive; and the transport charges, which constituted the greater part of the total cost, were greater than the transport charges from the Midlands. A similar position arose with regard to the cost of silica or sea sand. He had used a sea or river sand from a South Wales area; the company's works were situated near the South Wales border and the cost of carriage of that sand was comparatively low, but the sand was full of silt and mud, and subsequently it was found to be cheaper, by reason of the better results obtained, to buy silica sand from as far north as Southport. The cost of transporting a ton to the works was about 14s.

Vote of Thanks

Mr. V. C. Faulkner proposed a hearty vote of thanks to Mr. Newman for the Paper, and commented that it was perhaps appropriate that he should do so, because he had been responsible for Mr. Newman's invitation to address them. Moreover, on several occasions he had enjoyed the hospitality of Mr. Newman and his father at their very pleasantly situated works in the Cotswolds. The foundry there was extremely interesting, being built over a lake, and it was perhaps unique in that respect.

The problem of the use of old sand, to which Mr. Delport had referred, would become of increasing importance. Nowadays incinerators were available to the industry for the reclamation of core sands, and it seemed to him that in the future the old sand would be used to a much larger extent that it had been in the past. The importance of the problem would be appreciated from the fact that one large Yorkshire foundry carted out 90 tons of core sand per day, and had filled up land which was being converted into a park.

The London Branch was indeed grateful to Mr. Newman for having travelled to London for the purpose of presenting his Paper; and the members would be glad of the opportunity to welcome him again in the future in order that he might tell them something about other sections of his work in an equally-interesting manner.

Mr. F. Gentles seconded, and expressed gratitude to Mr. Newman for his lecture. He hoped that in the future he would be able to take advantage of the opportunity to visit the works of Newman, Hender, Limited.

The vote of thanks was carried with enthusiasm.

The Chairman added a word of gratitude to Mr. Newman for the frankness with which he had answered the questions put to him. His Paper was typical of the kind which gave the members of the Institute considerable assistance.

Mr. Newman responded, and repeated that the members would be very welcome indeed if they could visit his company's works. Having had the opportunity of visiting various foundries, from which he had always learned something, he was a great believer in reciprocation, so that each could help others to learn something to the benefit of trade as a whole.

Catalogue Received

Moulding Machines and Electric Vibrators. British Insulated Cables, Limited, of Prescot, Lancs, have prepared a 12-page, well-illustrated catalogue covering their range of magnetic moulding machines. Since we had the pleasure of seeing the first machine the company made some few years ago, considerable progress has been made, and now several models of various types are available. The catalogue lists a range of five squeeze-strip machines, one downsand-strip machine and a double-face boxless machine. Two pages of the brochure are given over to control gear, whilst the last page deals with electric vibrators, taking both a.c. and d.c. current. Vitreous enamellers will be interested to learn that this vibrator is being applied to the dry-dusting process. This really interesting brochure is available to our readers on request.

Richard Thomas & Company, Limited, it is reported, are planning to build a new strip mill at Irthlingborough, in Northamptonshire. No details are available pending an official statement.

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Productive Salesmanship

By ERIC N. SIMONS

At various times in these pages the writer has indicated a certain disbelief in old-time methods of salesmanship. As a result, he has occasionally been taken to task, mostly by his elders, and challenged to indicate in detail his conception of more intelligent and productive methods. It is not in his nature to refuse a challenge, and he has invariably replied at some length, and it is, perhaps, not uninteresting to summarise here the main heads of his argument.

In the early days the foundry salesman who could tell a good story, gossip amiably about matters in general, prevaricate occasionally with some fluency and gusto, and make himself agreeable to all and sundry, was able to get orders for castings. To some degree he can get orders for them to-day. That much is not denied. Whether he can create permanent accounts is less certain. Increasing industrialisation, competition and intelligence, tend to bring the day of the old-time salesman more and more to its close.

The writer does not speak without book. He has tried to sell castings himself, and most of his days he sits and listens to at least one salesman or other trying to sell him something. One fact emerges from these conversations. Of all the salesmen who complain of bad times and the difficulty of getting orders under modern conditions, at least 75 per cent. are of the old-fashioned type. Is not this in itself an indication that their methods are out of date or rapidly becoming so? The younger, better-trained salesmen may agree, in conversation, that times are not good, but they are always full of personal experiences of obtaining orders during periods of intense depression.

Emphasising Good Points

This is not mere fluking. There are definite reasons why these better-trained salesmen obtain orders when their elders often fail. The writer will quote one example from his own knowledge to prove this. A certain foundry salesman known to him sells a type of casting whose chief advantage is its truth to shape, whereas in some instances competing castings tend to deviate a little from perfect accuracy. In order to prove this point of accuracy, the salesman has to persuade the customer to order a sample casting or so, and compare the result with a casting of his existing type. The young salesman soon learned that mere declarations, backed up by racy conversation, did not succeed. No buyer would be hypnotised into placing an actual order. He perceived that new selling methods were necessary.

First of all, therefore, this salesman endeavoured to find out as much as he could about the castings, their manufacture, and the material from which they were made. He obtained permission to spend some time in the foundry. He was not a skilled foundryman, but he saw the material, watched the castings being made, looked at their internal structure through the microscope, ascertained and memorised their analysis, watched moulding methods, and talked to anyone and everyone who could teach him something valuable about the castings it was his task to sell.

He then felt a desire to know more of the market for the castings, and from the sales department records found out the typical uses for these castings and the types of industries in which they were being adopted. With all this information at his finger-ends, he was better equipped to resume his salesmanship.

He did not, however, at once set out. He took, first, his list of industries, and at the reference library in the town where the foundry was situated, looked up whatever accounts he could find of the manufacturing processes in these industries, so as to find out as far as he could the exact scope of application for the castings, and the exact conditions they would be called upon to meet. He then took the directories of the various towns in which he had to sell, and made out proper lists of prospective customers in each class of industry, grouping these in order of accessibility. Thus, if boot-makers had a use for the castings in question, he first learnt what he could about boot manufacturing and his castings in relation to it, looked up all the boot manufacturers in, say, Leicester, grouped them in order of easy access, and then passed on with these carefully compiled lists to his accounts department.

There he found an invaluable compilation which gives credit ratings for any and every class of purchaser, and he went through his lists with this, and deleted the names of all doubtful and insignificant prospects. The writer does not wish to suggest that he did this for every industry at once. But he made a point of, as far as possible, concentrating on each industry in turn on his repeated journeys.

A Better Introduction

What was the result? He reached his first town of call with a fairly wide knowledge of what he was selling; what his castings could accomplish; who was likely to buy them; and the potential value of these buyers as customers. He was able, when he called upon a buyer, to say to him, not: "Do you use these castings at all in your works?" but: "Why do you use such and such a material for your castings, and run the risk of wear on your parts through inaccuracy?" In brief, he set himself from the beginning to study how he could save his own and his customers' time, trouble and money.

A good deal of the work of making his firm known which the old-time salesman used to do is now being done for him by efficient advertising, circularising, and house organs. The salesman finds his firm already known when he calls, if his publicity department has done its work well. He has no longer to spend time and energy in *introducing* his goods and his firm, to the same extent. Therefore, it is all the more important that he should practice scientific and intelligent methods of salesmanship.

Helping the Buyer

The writer has outlined the preparatory work which modern salesmen put in. In the work of actual selling they follow certain simple and safe rules. First of all, they endeavour to serve the customer by showing him where and how he can save money. An intelligent and observant foundry salesman is always picking up general hints which he can pass on to his customers. One salesman always obtains an interview wherever he calls, because he helps the buyer in his work.

Modern salesmen do not hesitate to make full use of the literature their firms issue. Some salesmen (old-timers) argue against carrying literature, that "it bulks" and weighs heavily. This objection can be met by having a little leather portfolio with suitably-arranged flaps or pockets in which the catalogues, etc., can be kept. In these days, when salesmen use their cars as their offices, there is little validity in this excuse. A salesman will often find he can clinch an argument by pointing to a printed statement, which confirms his otherwise unverified verbal declaration. While it may not be practicable to carry samples of castings, there is no reason why the salesman should not carry little fractures showing the good points of the internal structure. These can be set out in little compact boxes and covered with glass, the whole not taking up more space than a card case, if well designed. Or if fractures tell nothing, a series of photographs handsomely bound up, or even one of the modern talking or silent films, may prove a good speculation.

Modern Salesmanship

The modern salesman approaches his job with some attempt at organisation. He reports accurately. He gets names and addresses down correctly (nothing is more exasperating to a sales department than carelessly and incorrectly written addresses of customers). He knows where to find quickly the information he wants. He never "blows in" on the off-chance. He does not assume that Jones is interested in golf, and start discussing his famous game with Smith, when the fact is that Jones detests golf. He carries his prices with him (as far as he can); he reads the literature about his castings sent to him by his employers; he does not fatuously inquire: "Have we any catalogue about . . . ?" when only a month before a booklet of that very type had been sent to him for his use. He does not say: "Please send my friend Smith our casting literature" when what Smith wants is some information on castings for pumps for use in sea water, and the foundry publishes a dozen catalogues of castings, eleven of which are of no use to Smith.

All these things are, regrettably, done to-day by old-time salesmen. It is not their fault. That is how they were taught to sell, and it says something for their energy and perseverance, their courage and likeableness, that with all their handicaps they did so well. But the world is changing, and it will not stay its course because "old Brown is a nice old chap, and has served us very well for many years." No one wants to do anything that will hurt or shatter Brown. The younger men, however, must not be brought up in the Brown tradition. The world needs something more efficient to-day.

Company Meeting

The annual meeting of the British Aluminium Company, Limited, was held in London last week. Mr. R. W. Cooper (chairman of the company), who presided, said that they had marketed a rather larger tonnage of aluminium, although there was a small reduction in the average prices taken for some of their products. The volume of metal imported into the country was considerably larger than in the previous year, and competition was thereby intensified. The use of aluminium expanded to a further extent during the year in most countries, very notably in Germany, where difficulties of exchange had resulted in a large reduction in the imports of copper and other non-ferrous metals; locally-produced aluminium being substituted. The applications of the metal in that country had in consequence widened to a large extent, and it might be expected that certain of these uses would in due time extend to other countries. Notwithstanding the active internal demand, Germany continued to export large quantities of aluminium foil and other rolling-mill products at very low prices—in many instances at prices well below the bare works cost of production. This was possible only by reason of subsidies and barter for other materials which Germany required. They had suffered considerably because of this barter system, particularly in India, where they had hopes of some revival of the important trade they did in that territory for many years before the low prices of brass induced the Indian population to return to the use of utensils made in that alloy instead of in aluminium. The general improvement in the trade of Great Britain had been reflected to some extent in their home sales. Their various works had operated satisfactorily throughout the year, and the Lochaber Works continued to realise expectations.

Harland & Wolff, Limited. Govan, have booked an order for a motor coaster from the North Coast Steam Navigation Company, Limited, Sydney.

Genuine Blast Furnace ALL-MINE SPECIAL PIG IRONS

G. & R. THOMAS LTD., HATHERTON FURNACES, BLOXWICH

Telephone : Bloxwich 6341. **Telegrams : "Thomas, Bloxwich."**

Date back to the year 1844, and during the whole of this period have been producing Special Pig Irons for the Engineering and Roll Founding Trades, smelted in their open-topped Blast Furnaces from the celebrated South Staffordshire Clayband Ironstone with a large proportion of Staffordshire Deep Mine Coal, both of which are mined in the vicinity. These materials, together with the exceedingly slow rate of smelting with Cold or Warm Air Blast, impart to the resultant pig iron those important characteristics of Toughness, Strength, Closeness of Grain and Resistance to Wear, which cannot be obtained in any other way.

The Irons are supplied in the following Brands and Fractures and Analyses will be submitted on application.

"HATHERTON."

An inexpensive Blast Furnace made Pig Iron possessing low Carbon, Silicon, Sulphur, Phosphorus and High Manganese, making it very suitable for Cylinder and Similar Castings where strength and freedom from Porosity are so necessary.

G. & R. T. "TITAN."

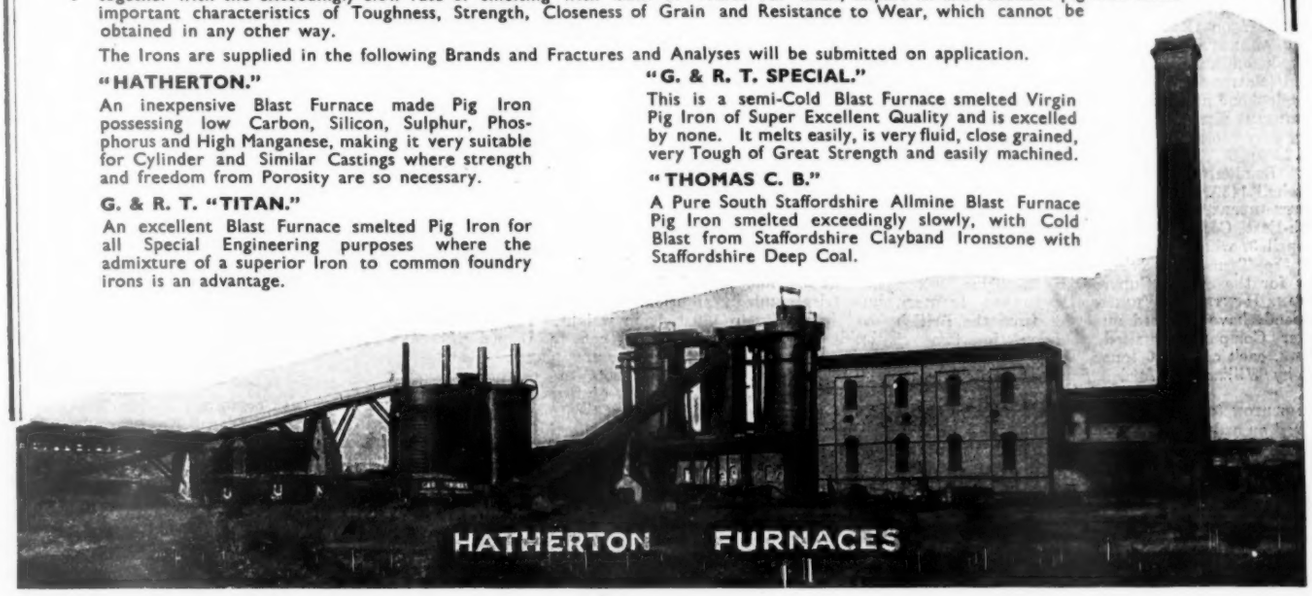
An excellent Blast Furnace smelted Pig Iron for all Special Engineering purposes where the admixture of a superior Iron to common foundry irons is an advantage.

"G. & R. T. SPECIAL."

This is a semi-Cold Blast Furnace smelted Virgin Pig Iron of Super Excellent Quality and is excelled by none. It melts easily, is very fluid, close grained, very Tough of Great Strength and easily machined.

"THOMAS C. B."

A Pure South Staffordshire Allmine Blast Furnace Pig Iron smelted exceedingly slowly, with Cold Blast from Staffordshire Clayband Ironstone with Staffordshire Deep Coal.



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This Week's News in Brief

Trade Talk

ROBERT BROADBENT & SONS, LIMITED, of Stalybridge, textile-machinery manufacturers, celebrate their centenary this year.

HENRY BALFOUR & COMPANY, LIMITED, of Leven, have secured the contract for the new gasholder at Kelty, which will have a capacity of 150,000 cub. ft.

THE E.L.M.A. LIGHTING SERVICE BUREAU has arranged to hold two-day conferences on works and office lighting in London on May 19 and 20, and at Manchester on October 6 and 7.

THE ADDRESS of the British Oxygen Company, Limited, on and after April 14, will be Thames House (Entrance No. 3), Millbank, London, S.W.1. The telephone number (Victoria 9225) is unchanged.

KENNETH HILL & COMPANY, blast-cleaning engineers, have removed from Aldwych House, Aldwych, W.C.2, to St. Stephen's House, Victoria Embankment, London, S.W.1. The telephone number is Whitehall 1459.

SIXTY REPRESENTATIVES of trade unions on the North-East Coast held a conference at Newcastle on April 3, when it was agreed to open a campaign with the Tyneside Advisory Council to bring the order for the second Cunarder to the Tyne.

SWAN, HUNTER & WIGHAM RICHARDSON, LIMITED, Wallsend, have received an order from the British Tanker Company, Limited, London, for two oil tankers, each of 12,500 tons. The engines are to be built by William Doxford & Sons, Limited, Sunderland.

LAMBERTON & COMPANY, LIMITED, Coatbridge, have received an order from John Lysaght, Limited, Newport, for two stands of cold-rolling mills of special design by the United Engineering & Foundry Company, of Pittsburgh. The mills will produce high-grade sheets up to 80 in. wide for the motor trade.

THE BRITISH TANKER COMPANY, LIMITED, a subsidiary of the Anglo-Iranian Oil Company, have placed orders for three tankers worth £500,000, two with Harland & Wolff, Limited, of Govan, and the other from Lithgows, Limited, Port Glasgow. The machinery in the latter case will be supplied by John G. Kincaid & Company, Limited, of Greenock.

AT THE THEATRE of the Western Electric Company, Limited, Bush House, London, on Thursday last, British Timken, Limited, gave an exhibition of films showing the manufacture in England of what they claim to be the world's largest roller bearing, and the application of roller bearings to continuous strip mills.

IN THE ANNUAL REPORT of the Ironfounding Workers' Association, reference is made to the marked improvement which has taken place in the trade within the past twelve months. The report states there is abundant evidence that the trade has gradually emerged from a long period of distressing and painful economic experience.

THE ADMIRALTY have decided, subject to the adjustment of certain points of detail, to place orders with Clyde yards for five Tribal class destroyers. Scott's Shipbuilding & Engineering Company, Limited, Greenock, will build the hulls and machinery for two vessels; William Denny & Bros., Limited, of Dumbarton, will also build two hulls and machinery, and Alexander Stephen & Sons, Limited, Linthouse, will build the hull and machinery for one vessel.

THE ANNUAL MEETING of the Ayrshire District of the Foremen's Mutual Benefit Society was held in the Welfare Hall of Glenfield & Kennedy, Limited, Kilmarnock, when Mr. E. Bruce Ball, managing director of Glenfield & Kennedy, presided. The annual report submitted by Mr. W. McQueen showed that the Society was in a sound position and making good progress. He referred to the pensions scheme as the most important benefit of the Society, which spent over £100,000 per year.

VICKERS, LIMITED, announce that the Alfa-Laval Company, Limited, of Brentford, have now acquired from Cooke, Troughton & Simms, Limited, the business of British Separators, Limited, whose machines are known throughout the trade as "Vickcen" separators, and have been installed in the "Queen Mary." As from April 1, all inquiries for "Vickcen" separators, filters and parts should be addressed to British Separators, Limited, at their new address, Great West Road, Brentford, Middlesex.

THE WEST OF SCOTLAND pig-iron and steelmaking industries are now producing more material than at any time since 1929. An additional redesigned blast furnace has been blown in at Clyde Iron Works. Further blast furnaces are expected to go into commission as soon as the new coke ovens at the Govan works of William Dixon, Limited, are producing metallurgical coke. The coke plant is at present heating up, but when in full operation will produce sufficient coke to keep two blast furnaces supplied. The Lanarkshire Steel Company, Limited, project another steel-smelting furnace at their Flemington works, and Colvilles, Limited, have recently had 13 furnaces in production at their Dalzell works, Motherwell, the largest number for nine years.

THE ANNOUNCEMENT by the English Steel Corporation, Limited, that the Darlington Forge, Limited, would recommence work early in 1936 was accompanied by the statement that the plant and equipment would be modernised throughout. The work of re-conditioning the buildings and installing new plant has moved rapidly since that announcement was made, and following a preliminary run in several of the departments, the works have definitely started production. The first cast of steel has been tapped in the melting department, which will at once go into full production. It will provide steel for use in the manufacture of forgings and castings for the marine, electrical and general engineering industries, and in addition, for carbon and alloy steel ingots up to 100 tons in weight. It has been decided for the time being not to reopen the light foundry nor to manufacture phosphor- and manganese-bronze castings, but to confine the foundry work to steel castings of from 15 cwts. to 100 tons in weight. New heat-treatment plant is being erected. Skilled men who left the Darlington Forge when it closed down in 1932 are returning. The company will continue to instal modern equipment, including new machine tools, to meet the developments in technique which have taken place since the works closed down.

Contracts Open

Bolton, April 16.—Cast-iron surface boxes and other castings, for the Town Council. The Waterworks Engineer, St. George's Street.

Green Street Green, April 27.—High-compression heavy fuel oil engine with centrifugal pumps, etc., for the Metropolitan Water Board. The Chief Engineer's Department (Room 235), 173, Rosebery Avenue, E.C.1. (Fee £2 2s., returnable.)

Johannesburg, May 5.—3,000-kw. steam turbine-driven alternator, auxiliaries, etc., and switchgear, for the Rand Water Board. The Department of Overseas Trade. (Reference T.Y. 40,017.)

Johannesburg, May 26.—Thirteen 4-ton level luffing electrically-driven portal jib cranes, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference T.Y. 30,012.)

Whittlesey, April 22.—Three groups of pumping plant, with motors, pipe connections, valves, switchgear, etc., for the Urban District Council. Messrs. G. B. Kershaw & Kaufman, 9, Victoria Street, Westminster, S.W.1. (Fee £5, returnable.)

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

R. W. Whittle, Limited, P.V. Works, Montonfields Road, Monton, Eccles.—Capital £2,000. Ironfounders, etc.

Redheugh Iron & Steel (1936), Limited.—Capital, £60,000. To acquire the business formerly carried on at Gateshead-on-Tyne by the Redheugh Iron & Steel Company (in liquidation). Directors: I. S. Miller, M. R. Proudlock, and Wm. L. Shepherd.

Richards (Leicester), Limited.—Capital £30,000. To take over the business of a constructional engineer and ironfounder carried on by W. Richards at Phœnix Works, Leicester, or alternatively, to enter into partnership with W. Richards. Directors: W. Richards, Mrs. B. Richards, W. H. Richards and C. H. Bosworth.

Personal

MR. C. H. KAIN'S ADDRESS, after April 12, will be Panfield Farm, Panfield, near Braintree, Essex. The telephone number will be Braintree 149.

MR. FRANK S. RUSSELL, managing director and chairman of General Refractories, Limited, has been appointed a director of the Refractories Industries Compensation Fund, Limited.

THE SOCIETY OF CHEMICAL INDUSTRY has awarded its Messel Medal this year to Sir Robert Mond. The medal, it will be remembered, is awarded to those who have attained eminence in applied chemistry, and is given in alternate years.

MR. J. A. E. WELLS has been appointed foundry manager of Edgar Allen & Company, Limited, Sheffield. Mr. Wells has been with the firm since 1907, and is the son of the late Mr. A. E. Wells, who was managing director of the firm.

Wills

FURNIVAL, E. H., of Sheffield, chief electrical engineer of Edgar Allen & Company, Limited, Imperial Steel Works	£2,814
BLUMER, JAMES, of Darlington, at one time manager of the mineral department of Bolckow, Vaughan & Company, Limited	£82,953

Obituary

THE DEATH HAS OCCURRED of Mr. William Moffat, retired manager of Town End Foundry, Limited, near Stockport, at the age of 75. He was well known in the iron trade. Some of his patents and improvements are incorporated in the plant of many foundries in the country.

THE DEATH OCCURRED, on March 29, of Mr. James Hamilton, secretary of the Scottish Iron & Steel Company, Limited. Mr. Hamilton, who was 79 years of age, rose from an office boy to a partner in the firm of William Tudhope & Sons, ironmakers, of Coatbridge, and in 1912 he became secretary of the Scottish Iron & Steel Company, in which his firm was absorbed.

Company Reports

Churchill Machine Tool Company, Limited.—Dividend on the 6 per cent. preference shares for 1935, plus participating dividend of 6 per cent. Ordinary dividend of 12 per cent.

P. & W. MacLellan, Limited.—Net profit, before charging interest on debentures, £9,416; debenture interest, £6,655; carried to profit and loss account, £2,760, which reduces the debit of £170,932 brought in to £168,172.

John Summers & Sons, Limited.—Net profit, after providing for depreciation, income tax, and debenture interest, £228,622; brought in, £184,534; dividend on the ordinary shares of 5 per cent. for the year; carried forward, £184,771.

Vickers-Armstrongs, Limited. — Profit for 1935, £1,130,756, including dividends on investments and £45,000 previously provided in respect of losses of a subsidiary company, no longer required; income tax, £293,105; directors' fees, £2,443; depreciation, £225,833; net profit, £609,374; brought in, £104,613; "A" preference dividend, less tax, for one year and ten months to September 30, 1933, £606,680; carried forward, £107,307.

Forthcoming Events

APRIL 21.

Institute of Welding, North-Eastern Branch:—Annual Meeting; a film will be shown, at the Institute of Mining and Mechanical Engineers, Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 7 p.m.

Institute of British Foundrymen

APRIL 17.

Middlesbrough Branch:—Annual Meeting, at the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7.45 p.m.

Sheffield Branch:—Annual Meeting; "Cast Iron," Paper by W. Woodhouse, at the Grand Hotel, Sheffield, at 7.30 p.m.

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THE ADMIRALTY,
WAR OFFICE, AIR MINISTRY,
INDIA AND HOME OFFICES.

DATE 25th.Feb. 1936.

REFERENCE AGP/EB.

Messrs. Foundry Engineers, Ltd.,
HALIFAX.
Yorks.

Dear Sirs,

In reply to your letter of the 13th.instant, we enclose herewith the two negatives of the Foundry Plant you recently installed for us.

We may say that the Plant continues to give satisfaction and we are obtaining the following output:-

Green Sand	-	25 cwts.	per hour.
Facing Sand	-	25 "	"
Oil Sand.	-	15 "	"

The plant is well ahead of our requirements and is running daily.

Yours faithfully,
REAVELL & CO.LTD.

encl.2 negatives.

Raw Material Markets

Most producers are in arrears with deliveries. Production of pig-iron is being increased and the steelworks are satisfying their demand for scrap by the importation of considerable tonnages from abroad. At a meeting of hematite makers in Birmingham last week the recent 4s. increase in quotations was ratified. Contracts up to July will be transacted at current prices, but sales beyond that date will be made subject to prices in force at time of delivery.

Pig-Iron

MIDDLESBROUGH.—New business in this area is now almost negligible owing to the stringency of supplies. Makers are disinclined to enter into new contracts until production has been increased sufficiently to enable them to complete existing commitments. Consumers' requirements are having to be augmented by supplies from other areas, notably the Midlands. The export trade remains neglected. Prices of Cleveland iron are nominal and unchanged. Deliveries after June 30 will be charged 5s. per ton more than the present values, which for No. 3 Cleveland G.M.B. are 70s. per ton in the Middlesbrough and Falkirk areas, 72s. on the North-East Coast and 73s. on Clydeside. In some cases business has been transacted at 2s. 6d. more than these figures, but has only involved small tonnages.

Production of East Coast hematite is now on an increased scale and supplies are moving into consumption more freely. New contracts for small tonnages have been arranged, but there is no difficulty in disposing of complete outputs immediately after production. Prices are now official and are based on the minimum of 77s. per ton for No. 1 hematite, delivered in the Middlesbrough and North-East Coast zones.

LANCASHIRE.—Trading conditions with the Lancashire foundries have been maintained satisfactorily, and iron is being taken up in large tonnages by the heavy electrical engineers, machine-tool makers, the light-castings foundries, and the jobbing foundries. Offers of Staffordshire, Derbyshire and Lancashire brands of No. 3 foundry iron, for delivery in the Lancashire price zone, are all at 78s. per ton, Northamptonshire at 76s. 6d. and Derbyshire forge iron at 73s., with deliveries after June 30 at 5s. per ton extra. Scottish iron is easily procurable at 87s. 6d. delivered in the Manchester area. West Coast hematite is on offer at 85s. 6d. and East Coast material at around 84s. 6d., both delivered this area.

MIDLANDS.—No price changes were effected at the recent meeting of the Central Pig-iron Producers' Association, and the present minimum Association rates delivered to Birmingham and Black Country stations are 72s. 6d. for Northants No. 3 and 75s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, subject to a small rebate to large consumers. Consumers are taking up large supplies against contracts, but new business is of little consequence. Activity among the light-castings trade is intensified by the demand for supplies for the spring building trade. Special irons are also well taken up, and offers of medium-phosphorus iron range from 80s. to 87s. 6d., and low-phosphorus from 92s. 6d. to 100s. per ton. Values of refined irons vary considerably and are from about £6 10s. to £7 15s. per ton, delivered South Staffordshire. Prices of hematite are now officially recognised at the recent advanced level of 4s. per ton, which leaves values at £4 8s. 6d. for West Coast mixed numbers, £4 7s. 6d. for East Coast No. 3, and £4 7s. for Welsh mixed numbers, delivered Midland stations, with 1s. 6d. per ton extra for delivery into works. Price uncertainties continue to restrict new business, but many users are well covered.

SCOTLAND.—New business has been more in evidence following the advance of 5s. per ton in foundry iron prices last week. The quotation for Scottish No. 3 foundry is 79s. f.o.t. furnaces, with 2s. 6d. per ton extra for No. 1. The output of basic iron will now be considerably increased following the addition of two furnaces to the production of this material. Activity with the light-castings founders continues unabated. Prices are unchanged at 70s. f.o.t. Falkirk and 73s. f.o.t. Glasgow for Middlesbrough iron, with Midland iron quoted at 1s. 3d. below these prices. Mixed numbers of Scottish hematite, West Coast hematite and East Coast hematite are still quoted at 77s. f.o.t. steelworks. The official price for basic, British and Indian, is 70s. (less 5s. rebate), delivered steelworks.

Coke

Deliveries of foundry coke against earlier contracts are on a good scale, but consumers are reluctant to enter into contracts for supplies for delivery after the end of June because they hope that lower quotations will rule, although there is little indication of this at the moment. Meanwhile, for delivery in the Birmingham area, best Durham coke is quoted from 41s. 6d. to 43s., with other grades down to 39s., while Welsh coke varies from 38s. 6d. to 50s. per ton.

Steel

The active conditions which have prevailed in the steel industry for a considerable period have been well maintained during the past week. Most steelworks have full order-books, and in some districts it is difficult to place new business. In the semi-finished market, trading is heavy, many consumers being anxious to replace expired contracts. Business in finished steel is on a good scale. Producers in this country are well employed and consumers are pressing them for deliveries.

Scrap

Imports of iron and steel scrap into the Cleveland district have again been of a considerable volume. It is understood that prices of imported material are rather higher than those of home scrap. Local steelmakers are still refusing to pay more than 57s. 6d. per ton as a delivered price for good, melting steel scrap and the demand for this material is heavy. Machinery cast-iron scrap remains at 65s., while ordinary heavy foundry metal is around 62s. 6d. The Midlands market maintains its firm tone. Supplies are moving more freely and as a result prices are slightly easier. Good, heavy, wrought iron is at 67s. 6d. to 70s. Heavy machinery metal in handy sizes is at 67s. 6d. to 70s., good heavy at 60s., and clean light at 52s. 6d. to 55s. Short, heavy, steel scrap, as used in the foundries, is in short supply at 65s. to 66s. per ton delivered works. Conditions on the Scottish market remain very active. Prices are firm. Heavy, mild-steel scrap is at 57s. 6d., with heavy basic or heavy iron and steel scrap mixed, 5s. less. A good demand exists for heavy machinery cast-iron scrap, in pieces not exceeding 1 cwt., and business has been done at 72s. 6d., while ordinary cast iron, to the same specification, is at 67s. 6d. to 68s. 6d. per ton delivered f.o.t. consumers' works.

Metals

Copper.—Interest in this market has been centred in the Continental demand at the end of last week, but this has now returned to more normal proportions. France was the most important consumer. Buying on trade account in this country has again been limited. The United States foreign trade returns show the extent of Italian purchases of copper in that country. The normal level of United States exports to Italy in the 18 months before the Abyssinian war was about 1,500 short tons a month. Last November the figure was 5,703 tons and in December 5,248 tons. In January the figure fell to 1,038 tons, but in February the total was up to 4,218 tons.

Daily market prices :—

Cash.—Thursday, £36 8s. 9d. to £36 10s.; Friday, £36 10s. to £36 11s. 3d.; Monday, £36 11s. 3d. to £36 12s. 6d.; Tuesday, £36 12s. 6d. to £36 13s. 9d.

Three Months.—Thursday, £36 13s. 9d. to £36 15s.; Friday, £36 16s. 3d. to £36 17s. 6d.; Monday, £36 16s. 3d. to £36 17s. 6d.; Tuesday, £36 18s. 9d. to £37.

Tin.—Conditions in this market have ruled quiet, and buying has not amounted to any substantial tonnage. In the United States new business has been on an increased scale, and users are showing more interest in forward deliveries. Consumption in Europe is reported to be maintained on a fairly satisfactory scale. The International Tin Committee's suggestions for a new tin agreement have been received, and are at present before the Government of the Federated Malay States, the Chamber of Mines and other bodies. The proposals are confidential, but it is understood that the Chamber of Mines has appointed a committee to examine and report on the suggestions.

Metal Exchange quotations were as follow :—

Cash.—Thursday, £213 15s. to £214; Friday, £214 10s. to £215; Monday, £214 10s. to £214 15s.; Tuesday, £212 10s. to £212 15s.

Three Months.—Thursday, £206 15s. to £207; Friday, £206 to £206 5s.; Monday, £206 5s. to £206 10s.; Tuesday, £205 to £205 5s.

Spelter.—Demand on trade account has been steady, with the brassmaking trade the heaviest consumer. Negotiations regarding the re-establishment of the Cartel seem to have made little progress, and the market has returned to its former state of slackness. At the present time there is little indication of any stimulus being imparted, and the market seems likely to remain featureless for a considerable time.

Official quotations were as follow :—

Ordinary.—Thursday, £15 12s. 6d.; Friday, £15 10s.; Monday, £15 7s. 6d.; Tuesday, £15 7s. 6d.

Lead.—Steady conditions have prevailed in this market throughout the week. Similar reports have also been received of the United States market, where consumers are well covered. Until a more decisive view is obtainable of the international situation this market is not expected to show much development.

Day-to-day quotations :—

Soft Foreign (Prompt).—Thursday, £16 7s. 6d.; Friday, £16 7s. 6d.; Monday, £16 3s. 9d.; Tuesday, £16 2s. 6d.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

439,543. Swift, Levick, & Sons, Limited, Horsburgh, G. D. L., and Tetley, F. W. Permanent magnets and alloys therefor.

439,590. Siemens & Halske Akt.-Ges. Induction furnace with an open iron yoke.

439,644. Guest, A. L., and Associated Electrical Industries, Limited. Electric-arc atomic hydrogen heating torches.

439,689. Groves, W. W. (I. G. Farbenindustrie Akt.-Ges.). Process of welding.

439,900. Dehn, F. B. (Carter, R. W., and Hume Steel, Limited). Electric-arc welding.

439,913. Schloemann Akt.-Ges., and Nehlsen, H. Rolling mills with direct individual driving of the rolls by electric motors.

439,940. Benjamin, R. Cold-rolling of sections which are to have different hardnesses and strengths at different cross-sectional parts.

439,975. Schjoth, E. Production of hard-metal alloys.

440,021. British Thomson-Houston Company, Limited. Electric-welding apparatus.

Correction.—We regret that our reporter made an error in the figures quoted by Mr. C. H. Kain at the recent inaugural meeting of the East Anglian Section of the London Branch at Ipswich. The figure of 2.3 per cent. for total carbon should read 2.7 per cent., and the words "between 3 and 4 per cent. T.C." should read "between 3 and 3.2 per cent. total carbon."

Scottish Industrial Development.—Sir James Lithgow, chairman of the Executive of the Scottish National Development Council and Past-President of the Federation of British Industries, has been appointed Chairman of the special committee appointed to examine the possibilities of improving the economic conditions in Scotland and also to consider questions affecting the extension of existing, or the creation of new, industries which might be referred to it by industrial or commercial bodies or by the Commissioner for Special Areas. Dr. A. M'Cance, director and general manager of Colvilles, Limited, and director of Clyde Alloy Steel Company, Limited; Dr. J. Donald Pollock, O.B.E., chairman and managing director of Metal Industries, Limited; and Mr. N. W. Duthie, a partner in Mann, Judd, Gordon & Company, Glasgow, have been appointed members of the committee.

CROSSING THE BORDER

and the penalty

YOU see there are many good Iron Founders in the Midlands, and in the South for that matter, who have a secret yearning to mould again with a genuine Scottish Rock Sand, such as perhaps they have once been used to. They like the heavy bond, the coarse grains, the high permeability . . . Others have never known such luxuries.

The trouble comes from not being able to move large chunks of mother-earth down South from the banks and braes without the penalty of spending a lot of money—a deplorable thought!

But the merrily tapping of wayside rocks with our little geological hammers and our love of digging holes have taken effect. We've discovered nature's bounty in a natural rock moulding sand within easy reach of *the Midlands*. (EUREKA!)

It is christened Tor Rock Sand, and we baptize it with just enough water in a painstaking mill to give a wonderfully plastic, coarse, cohesive sand—a moulder's delight.

The scientific fellows say it's like this:—

CHEMICAL ANALYSIS.

Silica	86·8 %
Ferric Oxide	1·43%
Alumina	7·6 %
Lime	·22%
Magnesia	·18%
Titanic Oxide	·18%
Alkalies	1·8 %
Loss on ignition	1·6 %

MECHANICAL ANALYSIS.

Very Coarse Sand (+ 1 mm) ..	16·5%
Coarse Sand (+·5 mm − 1 mm) ..	16·0%
Medium Sand (+ ·25 mm − ·5 mm)	11·0%
Fine Sand (+ ·1 mm − ·25 mm) ..	30·0%
Silt Grade (+ ·01 mm − ·1 mm) ..	7·0%
Clay Grade (− ·01 mm)	19·5%

which doesn't explain everything, but we will if you will write to us.

GENERAL REFRACTORIES

LIMITED

Genefax House, Sheffield

Telephone: Sheffield 31113 (6 lines).
Telegrams: "Genefax, Sheffield."

LONDON OFFICE:
Russell House, Adelphi, W.C.2.
Telephone: Temple Bar 7361.
Telegrams: "Genefax, Rand-London."

SCOTTISH OFFICE:
156, St. Vincent Street, Glasgow.
Telephone: 5250.
Telegrams: "Genefax, Glasgow."

SOUTH WALES OFFICE:
11, Wind Street Swansea.
Telephone: 3680.
Telegrams: "Genefax, Swansea."

and Branch Offices, Works and Agencies throughout the world.

RAW MATERIALS—PRICE LIST

(Tuesday, April 7, 1936)

COPPER

	£ s. d.
Standard cash	36 12 6
Three months	36 18 9
Electrolytic	40 15 0
Tough	39 5 0
Best selected	39 15 0
Sheets	68 0 0
India	50 5 0
Wire bars	41 0 0
Ingot bars	41 0 0
H.C. wire rods	44 10 0
Off. av. cash, Mar.	36 1 5 8/11
Do., 3 mths., Mar.	36 8 5 13/22
Do., Sttlmnt., Mar.	36 1 3
Do., Electro, Mar.	40 8 6 21/22
Do., B.S., Mar.	40 0 3 1/3
Do., wire bars, Mar.	40 12 7 4/11
Solid drawn tubes	10½d.
Brazed tubes	10½d.
Wire	6½d.

BRASS

Solid drawn tubes	9¾d.
Brazed tubes	11¼d.
Rods, drawn	8¾d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	8d.
Wire	7¾d.
Rolled metal	7¼d.
Yellow metal rods	5d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN

	£ s. d.
Standard cash	212 10 0
Three months	205 0 0
English	212 15 0
Bars	213 15 0
Straits	214 0 0
Australian	213 0 0
Eastern	208 5 0
Banca	214 0 0
Off. av. cash, Mar.	213 7 3 5/11
Do., 3 mths., Mar.	204 14 8 13/22
Do., Sttlmt., Mar.	213 5 2 7/11

SPELTER

	£ s. d.
Ordinary	15 7 6
Remelted	12 17 6
Hard	12 0 0
Electro 99.9	17 10 0
English	16 2 6
India	13 2 6
Zinc dust	19 10 0
Zinc ashes	4 5 0
Off. aver., Mar.	16 1 8 25/44
Aver. spot, Mar.	15 19 7 1/11

LEAD

	£ s. d.
Soft foreign ppt.	16 2 6
Empire (nom.)	16 18 9
English	18 5 0
Off. average, Mar.	16 13 9
Average spot, Mar.	16 12 1 10/11

ALUMINIUM

Ingots	£100 to £105
Wire	1/3 to 1/4 lb.
Sheet and foil	1/2 to 1/4 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	23 0 0
Do., V.M. ex-whse.	24 15 0
Rods	27 15 0

ANTIMONY

	£ s. d.
English	72 0 0 to 73 0 0
Chinese, ex-whse.	60 0 0
Crude, c.i.f.	31 10 0

QUICKSILVER

	£ s. d.
Quicksilver	12 0 0 to 12 11 0

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	8 17 6
45/50%	12 15 0
75%	17 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free	4/6 lb. Mo.
Ferro-titanium—	
20/25% carbon-free	5d. lb.
Ferro-phosphorus, 20/25%	£21 0 0 to £22 0 0
Ferro-tungsten—	
80/85%	3/- lb.
Tungsten metal powder—	
98/99%	3/3 lb.
Ferro-chrome—	
2/4% car.	33 0 0
4/6% car.	21 15 0
6/8% car.	21 0 0
8/10% car.	21 0 0
Ferro-chrome—	
Max. 2% car.	33 10 0
Max. 1% car.	36 5 0
Max. 0.70% car.	37 5 0
70% carbon-free	9½d. lb.
Nickel—99.5/100%	£200 to £205
"F" nickel shot	£184 0 0
Ferro-cobalt, 98/99%	5/6 to 5/9 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£11 5 0 to 11 15 0
76/80% packed	£12 5 0 to 12 15 0
76/80% export	(nom.) £10 5 0
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated, basis 2-ton lots.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to ⅛ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	3 5 0	to 3 6 6
Mixed iron and steel	3 0 0	to 3 2 0
Heavy cast iron		2 17 6
Good machinery	3 2 6	to 3 5 0
Cleveland—		
Heavy steel		2 17 6
Steel turnings		2 0 0
Heavy cast iron	3 0 0	to 3 2 6
Heavy machinery	3 3 6	to 3 5 0
Midlands—		
Light cast-iron scrap	2 12 6	to 2 15 0
Heavy wrought iron	3 7 6	to 3 10 0
Steel turnings		2 2 6
Scotland—		
Heavy steel		2 17 6
Ordinary cast iron	3 7 6	to 3 8 6
Engineers' turnings		2 2 6
Cast-iron borings	1 17 6	to 1 18 6
Wrot-iron piling		3 10 0
Heavy machinery		3 12 6

London—Merchants' buying prices, delivered yard.

Copper (clean)	30 0 0
Brass	20 10 0
Lead (less usual draft)	15 10 0
Tea lead	11 0 0
Zinc	9 10 0
New aluminium cuttings	76 0 0
Braziery copper	27 0 0
Gunmetal	28 0 0
Hollow pewter	160 0 0
Shaped black pewter	120 0 0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	72/6
,, No. 3	70/-
,, at Falkirk	70/-
,, at Glasgow	73/-
,, No. 4	69/-
Forge No. 4	69/-
Hematite No. 1	77/-
Hematite M/Nos.	76/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	77/-
,, d/d Birm.	88/6
Malleable iron d/d Birm.	119/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	71/-
,, No. 3 fdry.	75/-
Northants forge	68/6
,, fdry. No. 3	72/6
,, fdry. No. 1	75/6
Derbyshire forge	71/-
,, fdry. No. 3	75/-
,, fdry. No. 1	78/-
Scotland—	
Foundry, No. 1, f.o.t.	81/6
,, No. 3, f.o.t.	79/-
Hem. M/Nos. d/d	77/-
Sheffield (d/d district)—	
Derby forge	68/6
,, fdry. No. 3	72/6
Lincs forge	68/6
,, fdry. No. 3	72/6
W.C. hematite	90/-
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	78/-
Staffs fdry. No. 3	78/-
Northants fdry. No. 3	76/6
Cleveland fdry. No. 3	78/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	87/6
Clyde, No. 3	87/6
Monkland, No. 3	87/6
Summerlee, No. 3	87/6
Eglinton, No. 3	87/6
Gartsherrie, No. 3	87/6
Shotts, No. 3	87/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)		10 2 6
Nut and bolt iron	8 10 0	to 9 0 0
Hoops	11 0 0	and up.
Marked bars (Staffs) f.o.t.		12 10 0
Gas strip	11 0 0	and up.
Bolts and nuts, ¾ in. × 4 in.	15 15 0	and up.
Steel—		
Plates, ship. etc.	8 15 0	to 8 17 6
Boiler plts.	9 5 0	to 9 7 6
Chequer plts.		10 7 6
Angles		8 7 6
Tees		9 7 6
Joists		8 15 0
Rounds and squares, 3 in. to 5½ in.		9 7 6
Rounds under 3 in. to ⅜ in. (Untested)		9 1 0
Flats—8 in. wide and over		8 12 6
,, under 8 in. and over 5 in.		8 17 6
Rails, heavy	8 5 0	to 8 10 0
Fishplates		12 10 0
Hoops (Staffs)		9 16 0
Black sheets, 24g. (4-t. lots)		11 10 0
Galv. cor. shts. (,,)		13 10 0
Galv. flat shts. (,,)		14 0 0
Galv. fencing wire, 8g. plain		15 0 0
Billets, soft	5 17 6	and up.
Billets, hard	6 17 6	to 7 2 6
Sheet bars	5 15 0	to 6 0 0
Tin bars	5 15 0	to 6 0 0

PHOSPHOR BRONZE

	Per lb. basis
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12½d.
Rods	11½d.
Tubes	14d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	21.31
No. 2 foundry, Valley	19.50
No. 2 foundry, Birm.	15.50
Basic, Valley	19.00
Malleable, Valley	19.50
Grey forge, Valley	19.00
Ferro-mang. 80%, seaboard	75.00
O.-h. rails, h'y, at mill	36.37½
Billets	28.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.85
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.80
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.10
Plain wire	2.30
Barbed wire, galv.	2.50
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	20/- to 21/-
Durham foundry	23/6 to 24/6
,, furnace	21/-
Scotland, foundry	30/-
,, furnace	25/- to 26/-

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	18/9
,,	28×20 ,,	37/6
,,	20×10 ,,	27/-
,,	18¾×14 ,,	19/6
C.W.	20×14 ,,	15/9 to 16/3
,,	28×20 ,,	34/3
,,	20×10 ,,	23/-
,,	18¾×14 ,,	15/9 to 16/-

SWEDISH CHARCOAL IRON & STEEL

Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

	£ s. d.	
April 2 ..	36 8 9 dec.	3/9
,, 3 ..	36 10 0 inc.	1/3
,, 6 ..	36 11 3 ,,	1/3
,, 7 ..	36 12 6 ,,	1/3

Standard Tin (cash)

	£ s. d.	
April 2 ..	213 15 0 inc.	50/-
,, 3 ..	214 10 0 ,,	15/-
,, 6 ..	214 10 0 No	change
,, 7 ..	212 10 0 dec.	40/-

Spelter (ordinary)

	£ s. d.	
April 2 ..	15 12 6 dec.	6/3
,, 3 ..	15 10 0 ,,	2/6
,, 6 ..	15 7 6 ,,	2/6
,, 7 ..	15 7 6 No	change

Zinc Sheets (English)

	£ s. d.	
April 2 ..	23 10 0 dec.	5/-
,, 3 ..	23 5 0 ,,	5/-
,, 6 ..	23 0 0 ,,	5/-
,, 7 ..	23 0 0 No	change

Electrolytic Copper

	£ s. d.	
April 2 ..	40 12 6 No	change
,, 3 ..	40 12 6 ,,	,,
,, 6 ..	40 12 6 ,,	,,
,, 7 ..	40 15 0 inc.	2/6

Tin (English ingots)

	£ s. d.	
April 2 ..	214 0 0 inc.	55/-
,, 3 ..	214 10 0 ,,	10/-
,, 6 ..	214 15 0 ,,	5/-
,, 7 ..	212 15 0 dec.	40/-

Spelter (Electro, 99.9 per cent.)

	£ s. d.	
April 2 ..	17 15 0 dec.	3/9
,, 3 ..	17 12 6 ,,	2/6
,, 6 ..	17 10 0 ,,	2/6
,, 7 ..	17 10 0 No	change

Lead (English)

	£ s. d.	
April 2 ..	18 10 0 No	change
,, 3 ..	18 10 0 ,,	,,
,, 6 ..	18 5 0 dec.	5/-
,, 7 ..	18 5 0 No	change

AVERAGE MONTHLY PRICES OF CLEVELAND No. 3 PIG-IRON.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1896	37 3	38 4	38 7	38 1	37 4	37 4	36 11	36 11	37 11	39 2	40 5	40 5	38 3
1897	41 2	40 4	40 5	39 2	39 7	40 9	39 6	40 5	41 7	42 5	41 5	40 4	40 7
1898	40 9	40 8	40 6	40 0	40 7	39 11	40 4	41 11	43 0	44 11	49 1	44 3	42 0
1899	46 10	47 11	47 9	49 10	55 11	62 10	71 6	65 9	67 7	68 8	70 0	66 9	60 5
1900	67 10	68 10	73 10	76 2	74 2	68 6	69 3	71 4	70 9	67 8	63 6	53 6	68 9
1901	48 0	46 6	45 8	45 5	45 10	44 7	44 6	45 3	45 3	45 3	43 6	43 1	45 3
1902	43 11	46 7	46 9	47 11	48 10	49 7	50 9	52 1	53 6	52 9	50 9	47 11	49 3
1903	47 3	48 9	51 10	49 0	46 1	46 2	46 7	46 8	45 7	43 6	42 10	41 11	46 4
1904	42 3	42 7	43 3	44 7	44 0	42 10	42 9	43 3	43 1	43 9	46 1	48 7	43 11
1905	48 11	48 0	49 6	50 1	51 5	45 6	45 9	47 5	48 8	52 11	52 9	53 3	49 6
1906	53 9	50 1	48 1	48 8	50 2	50 3	50 6	53 0	54 6	56 8	58 6	62 4	53 6
1907	60 4	56 6	54 10	56 0	61 1	58 1	57 8	57 8	55 7	54 8	50 8	50 0	56 2
1908	48 5	49 3	51 7	51 10	51 6	51 2	50 0	51 4	52 0	49 8	49 4	48 11	50 8
1909	48 10	48 1	46 9	47 9	48 4	48 9	48 6	50 5	51 3	51 11	51 2	50 7	49 4
1910	51 10	51 3½	51 7½	50 10	49 10	49 2	48 10	49 8½	49 3½	49 7½	49 6½	49 10	50 4
1911	49 11½	49 2½	48 5	46 11	46 4	46 6	46 11½	47 4	47 0	46 7	47 4½	48 1	47 7
1912	50 0	49 5½	51 1½	53 7½	54 4	55 1	57 5½	64 6½	61 7½	66 8½	67 8	68 0	58 5½
1913	66 11½	63 8½	64 8	67 1½	66 3	56 9½	56 3½	55 8	55 4	53 0	50 1	50 4	58 10
1914	50 11	51 5½	51 0½	51 4½	51 6	51 6½	51 5	52 3	51 5	50 1	50 3	53 0	51 4½
1915	55 7	56 6	61 0	66 7	65 2	66 10	65 4	66 0½	65 3	65 11	69 10½	75 7½	65 7
1916	80 2	91 6	87 4½	86 10	82 6	82 6	87 6	87 6	87 6	87 6	87 6	87 6	86 10
1917	87 6	87 6	87 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	95 0	99 3
1918	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0
1919	95 0	95 0	95 0	95 0	152 6	160 0	160 0	160 0	160 0	160 0	160 0	160 0	137 8
1920	175 0	175 0	187 6	200 0	208 0	217 6	217 6	221 0	225 0	225 0	225 0	225 0	209 3
1921	222 6	195 0	150 0	126 0	120 0	120 0	120 0	136 3	127 0	120 0	110 0	100 0	137 4
1922	92 6	90 0	90 0	90 0	90 0	90 0	89 0	87 3	92 6	92 6	92 6	91 3½	90 7½
1923	94 6	108 9	125 6	129 4½	128 5	136 0	128 1½	121 11	97 1½	97 0	100 0	100 0	110 6½
1924	99 10	97 3½	91 9	93 9	91 9	89 10½	87 9	85 0	82 5½	80 2½	81 9	81 9	88 7½
1925	80 4½	78 10½	78 0	78 3	76 0	73 10½	71 7½	69 10½	68 1½	66 7½	66 0	66 10½	72 10½
1926	69 4½	70 0	70 0	70 0	72 6	75 10½	86 7½	90 0	93 10½	117 10	120 0	99 0	86 3
1927	85 0	83 1½	81 0	80 0	73 9	70 0	70 0	68 9	67 6	67 6	66 10½	65 0	73 2½
1928	65 0	65 0	65 6	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	65 9½
1929	66 0	66 9	67 0	68 1½	69 5	71 10½	72 9	72 6	72 6	72 6	72 6	72 6	70 4½
1930	72 6	72 6	70 0	67 6	67 6	67 6	67 6	64 6	63 6	63 6	63 6	63 6	66 11½
1931	59 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 7
1932	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6
1933*	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6
1934*	62 6	65 0	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	66 10½
1935*	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	67 6	69 4½	70 0	67 10½
1936*	70 0	70 0	70 0	—	—	—	—	—	—	—	—	—	—

* Delivered Middlesbrough area. Prior to 1933, prices were f.o.t. furnaces.

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

LUMPEX

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

FOUNDRY Engineer (38) desires executive position. Trained metallurgist. Over 20 years' experience in foundry work of every description, high-duty irons, alloy steels, special bronzes, castings and ingots, foundry lay-out, plant, equipment, etc. Offer of reasonable tonnage in special castings. Principals only.—Write Box 660, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

METALLURGIST, age 37, first-class training and experience in steel and iron foundry work; special alloyed steels and iron manufactured by the high-frequency induction, electric-arc and Bessemer furnaces; analysis, metallography, heat-treatment; up-to-date mass-production methods; 12 years' Continental experience and organisation; fluent French; requires post with scope for advancement.—Box 654, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Foreman wanted; general engineering castings up to 5 tons. State age, experience, salary required, and when available.—OXFORD & COWLEY IRONWORKS, Cowley, Oxford.

HEAD Foreman Iron Moulder wanted for large foundry in the West of Scotland producing the highest and heaviest class of marine and general engineering castings. Age and full particulars of experience to be given.—Box 670, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED.—Rate-fixer for Malleable Iron-foundry. Must be practical man with experience of floor, bench and machine moulding. State experience and salary.—Box 668, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

WANTED.—Working Foreman with good practical experience for foundry in West of Scotland engaged in general engineering castings. Apply in writing, stating terms, experience, etc., to Box 672, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

FOREMAN Patternmaker seeks position; wide experience in motor trade, aero work and general engineering. Good foundry experience and capable organiser. Excellent credentials. (271)

ASSISTANT Foundry Manager desires re-engagement. Has had charge of mechanised plant, also general foundry experience. Cupola control. Sound technical training. (275)

PROPERTY

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